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ABSTRACT

This document reports results of two applications of an alternative cost model to two-year college education programs. Purpose of the study was to identify nonoperational costs (costs other than instruction) that are not usually found in financial reports. Current educational cost practices report costs by jurisdictional units; the way costs are organized reflects the institution's organization. An alternative method--the functional approach--is described as more revealing of the true costs of a program. Cost studies were performed for two different programs, an occupational therapy program and a college preparatory chemistry program. This report closes with observations concerning implementation of a functional cost analysis, comments about how the two studies will be used internally, and a recommendation for those interested in further developing functional cost analyses evaluations. (Author/LD)

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Research Publication 78-4
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COSTING INSTRUCTIONAL PROGRAMS

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PREFACE

This document reports results of two applications of a cost model to two-year college education programs. The study was exploratory. The intent of the study was to provide more information about the purpose for which costs were incurred than is provided via the prevailing institutional financial reports. This was to be accomplished by identifying a cost analysis model and developing procedures which would collect and display educational cost data in instructionally meaningful categories. If application of the cost model and procedures resulted in greater clarity of the relationship between resource inputs and program outputs, it would be judged appropriate to develop materials for training two-year college personnel to conduct similar cost analyses.

Reports were prepared for each application of the model and are included as an integral part of this document. They are printed on colored stock in order to permit the reader to easily identify and scan the reports.

The model and procedures developed are not intended as financial accounting tools. They are more appropriate to program evaluation and use existing cost information in a restructured program framework. The conceptual cost model provides guidelines for such restructuring.

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Dr. Dominic Eanello, Vice Chancellor, Dean for Academic Affairs, Hudson Valley Community College;

Dr. David Humphrey, Director, Educational Development, Office of Academic Policy, S.U.N.Y.;

Michael Radlick, Associate Director, Curriculum Services, NYS Education Department, Bureau of Educational Communication;

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PART I

INTRODUCTION

Increasingly, educators are admonished to provide "cost effective" education; increasingly, evaluators are charged to examine cost issues; and increasingly, funding agencies review proposals with "cost benefits" uppermost in mind. Unfortunately for all, educational costs are often so insensitively related to the educational process and to instructional goals and outcomes that there is very little meaning in reported figures. It is a simple enough matter to state that a program cost X dollars and to further express the costs as costs per student or credit hour. However, the expressed costs are usually determined by adding the instructors' salaries to some proportional (usually by student enrollment) amount of overhead costs.

The expressions of cost are of little value to evaluators or others interested in specific aspects of program costs because they are at best a gross approximation of a program's cost. The costs are assumed to reflect the costs of classroom instruction; but, as with the proverbial iceberg, this visible portion of an instructional program is not a reliable indicator of the size or configuration of the total program. In recent years, as pressures for change and accountability have become more pronounced, more time and effort have been invested in the "hidden" development and planning aspects of instructional programs. To ignore the costs of this aspect--or worse, deny there is such a cost (because teaching professionals are expected to "donate" such time)--is to present a distorted view of educational costs.

Existing educational cost structures are not designed to identify non-operational costs (costs other than instruction). Thus if full portrayal of program costs is desired, an alternative approach to costing is required. This report is an explication and exploration of such an alternative cost framework.

Functional Cost Analysis

Current educational cost practices report costs by jurisdictional units; that is, the way costs are organized reflects the institution's organization. Typical cost categories include: faculty salaries, maintenance, administration, supplies, and equipment. These costs are frequently assigned to academic departments by assigning faculty salaries according to faculty appointment and by allocating most other costs according to some proportion rule such as floor space used by departments or the number of students enrolled in a department.

The jurisdictional approach to costing--although useful for meeting legal obligations and keeping financial affairs in order--is of marginal utility to educators, administrators, evaluators and other concerned parties. The alternative to organizing costs by jurisdiction is to organize them by function. In the context of this study, function has a multi-dimensional meaning. Function refers to the instructional purpose of the program., e.g., to instruct students in chemistry; it also refers to the life cycle stage of program development.

Life-cycle costing is a concept which evolved from work at RAND in the late fifties and early sixties (McCullough, 1966) and refers to identifying costs according to whether the costs were for Research and Development, Investment, or Operations. Figure 1 illustrates the concept of life-cycle costing. The overlap of the three phases indicates a source of potential difficulty in isolating costs by life-cycle: the appropriate life-cycle phase is determined by the nature of the task rather than by the time in which the task is carried out; therefore non-cost data must be collected and related to cost data. Because of this need for non-cost data, functional costing requires more effort than jurisdictional costing. The trade-off is that functional costing provides more information about how resources are utilized and is therefore more appropriate to program evalautions.

The particular cost model employed in this study is based on work by Doughty (1972) and Beilby (1977). Figure 2 presents an overview of the cost model. The horizontal axis contains cost categories while the vertical axis lists life-cycle phases. The cost associated with each cell is then determined. Figure 2 can represent the entire program or a single instructional function within the program...conceptually, the cost categories and life-cycle phases do not change.

Data Requirements

Data required to prepare a functional cost evaluation include a list of personnel, equipment, instructional materials and supplies utilized for a program; the salaries and cost of those resources; and the manner in which these resources are employed (i.e., life-cycle phase and program function).

Figure 1

Life-Cycle Costing

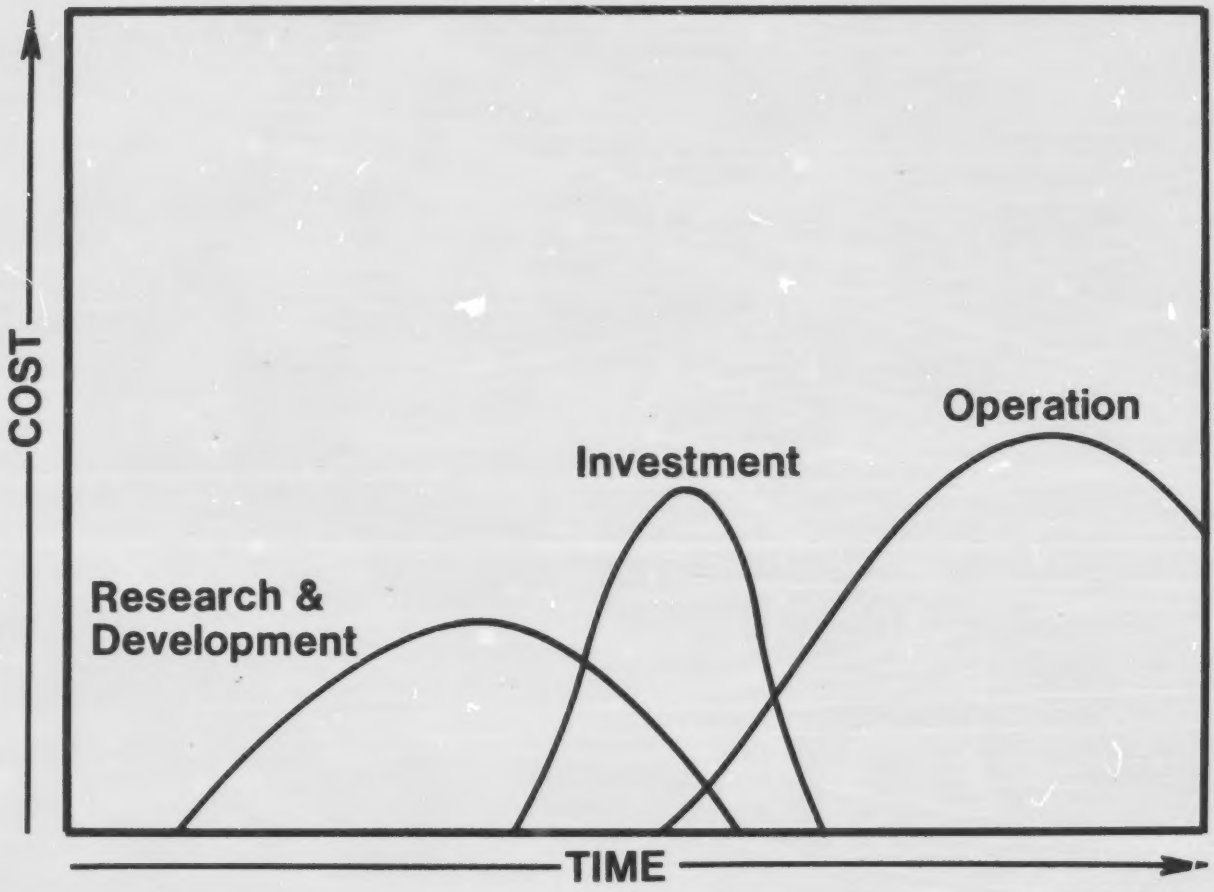

Figure 2

Conceptual Framework for a Functional Cost Analysis

Cost Categories / Life Cycle Phases	Category 1	Category 2	Category 3	Category 4...n	Total Costs
Design	$	$	$	$	$___
Investment/	$	$	$	$	$___
Operation	$	$	$	$	$___
Total Costs:	$_____	$_____	$_____	$_____	

To collect these data for the two studies contained in this report, three procedures were used: interviews with program personnel, examination of jurisdictional data and records, and--for oen program only--self reports of effort maintained by program personnel.

To complete the reports of effort, personnel identified by life-cycle and program function, the number of hours spent on the program each week. The form used is shown as Figure 3. These hourly record forms were used with just one program. The second study was an analysis of historical costs and the degree of personnel involvement was determined via interview. Prior to completing the record of hourly involvement, personnel were briefed about the nature of tasks to be considered as Design, Investment, and Operation. Figure 4 summarizes this information.

The number of hours spent on the project each week had no impact on total project cost. The data were used only to apportion the salary (divided into weekly portions) across program functions.

References

Beilby, A, A Functional Cost Analysis Process Applied to Selected Competency-Based Teacher Education Programs in New York State. (Doctoral dissertation, Syracuse University) Ann Arbor, Mischigan: University microfilms, 1977.

Doughty, P., Effectiveness, Cost, and Feasibility Analysis of a Course in College Level Geology. (Doctoral dissertation, the Florida State University) Ann Arbor, Michigan: University microfilms, 1972 No. 73-10, 325.

McCullough, J.D., Cost Analysis for Planning-Programming-Budgeting Cost-Benefit Studies. Santa Monica, California: The Rand Corporation, 1966. No. P-3479.

_____
(Name)

Staff Development | *Non-Traditional Instruction* | *Traditional Instruction*

	TOTAL PROFESSIONAL TIME/WEEK	PROJECT TIME			PROJECT TIME			PROJECT TIME		
		DESIGN	INVESTMENT	OPERATION	DESIGN	INVESTMENT	OPERATION	DESIGN	INVESTMENT	OPERATION
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Time spent - Week Ending _____	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs

FIGURE 3: LOG - Time Spent on Project

Functional Cost Analysis

ACTIVITY CHECKLIST

DESIGN	INVESTMENT/PRODUCTION	OPERATION
Planning the format, structure, and general content of course or program.	Purchase of hardware or equipment.	Classroom instruction.
Planning and designing specific content and nature of instructional materials to be used.	Purchase of instructional materials (books, paper, media, etc.).	Advising/counseling students.
Selecting from existing instructional materials.	Purchase of office supplies.	Evaluating/assessing students.
Planning required facilities.	Production of materials for class use.	Telling others about course or program.
Personal research to gain knowledge/information.	Cost of renovating facilities.	Instructional support activities (list type of activity and personnel involved).
Developing evaluation plan/procedures.	Rentals.	Pre-class review and preparation.
Evaluating instructional materials (for revision and future use).		

FIGURE 4: Activities by Life Cycle Phase

PART II

THE COST STUDIES

Two cost studies were performed and reports were prepared. These individual reports are included as an integral part of Part II, but on colored stock in order to identify them as separate studies.

Study No. 1 - Occupational Therapy

Recording Tasks By Life Cycle

The first study is a cost analysis of an Occupational Therapy (O.T.) program. The cost study was initiated at the beginning of the program and for that study program personnel maintained a record of their time on the form shown in Figure 3.

Faculty were able to identify tasks by life cycle stages without much difficulty, although they did indicate they would have felt more confident of making such discriminations if the analyst had been able to observe them at work and offer some initial clarification. However, lack of apparent discrepencies in the data suggests there were no classification difficulties or they were insignificant.

Faculty had no difficulty recording their time week-by-week...when they remembered. However, they omitted this task for a time and admitted it was not something they liked doing even though they recognized its importance.

Despite the fact that they found the task of recording their weekly involvement bothersome, faculty expressed confidence that the time recorded (and the time reconstructed--for those periods when they omitted recording their hourly involvement) was as accurate a portrayal of their involvement as could be obtained.

Summary of O.T. Cost Study Conclusions

The O.T. Analysis presents information from which certain conclusions can be drawn about the O.T. program. They are presented below, before the report, in order to cue the reader to look for certain elements in the report. Furthermore, since the original report was written rather quickly, not all of these conclusions are so clearly stated therein.

1. While one would expect the 19 weeks of the O.T. program to cost $10,014 (based only on the grant award for the year and using amortized equipment costs), the resources "consumed" during this period were valued at $11,405. This does not mean the college spent an additioanl $1,400 on the program. The extra amount reflects the value of miscellaneous secretarial services, administration, equipment, and (most of all) the salary of the project director. These costs were not reflected in the grant and were "in-kind" services supplied by the college. [*In reality, the college's share was closer to $3,000 since some equipment bargains increased the amount of money available to other areas. This tended to obscure the amount of college support*]. In exchange for this support, the college received services of an O.T. instructor valued at $6,000 and acquired equipment valued at over $15,000.

2. Enrollment in traditional instruction is near optimum (from the standpoint of efficiency) while a greater enrollment (10 to 20 additional students) in non-traditional instruction would noticeably improve the efficiency of that effort.

3. Design costs are--as expected--high for the non-traditional group. These costs should diminish over time, and may be viewed as investment costs [*NOTE: The second cost study illustrates some implications of viewing design costs as an investment*].

4. The professional development aspect of the program is being achieved for approximately $5,700. It should be noted that the greatest portion of this cost is attributable to salaries (most of which were covered by the grant). The remaining costs--software and hardware--were entirely covered by the grant. The college does not receive income from this effort--as in the case of the instructional programs--but does receive P.R. of undetermined value.

5. The staff put in very full weeks, averaging approximatley 60 hours per week. Although this involvement in no way increases the cost of the program, this "donated time" has real value. The costs presented in the report do not reflect this value, but the analyst estimates that the donated time was worth approximately $4,000. Interestingly enough, $4,000 was also the approximate amount of salaries attributable to the Professional Development aspect of the O.T. program.

The cost analysis of the Occupational Therapy program follows. The report and the procedures used to collect data have implications for future functional cost analyses. These implications are discussed in Part III.

The second cost study is introduced immediately following the O.T. report. It is a more ambitious and, to the investigator, a more satisfying use of the functional cost model. It carries the investigation beyond mere costing to computation of benefits based on derived costs.

A Functional Cost Analysis of
A Two-Year College Program
- Occupational Therapy -

BACKGROUND TO THE STUDY

An Allied Health project grant was awarded to the Occupational Therapy Department of a New York State community college to improve the working relationship between the trainer of Occupational Therapists (the community college) and the clinical setting which serve as training locations.

A Cost Issue

Due largely to joint costs, project budgets are often not very revealing of the actual amount of work and cost of a project. In the instance of the Allied Health project grant, the project director was officially listed at zero dollars/zero hours the first year and $1,000/100 hours the second year. The director was--on the surface--cooperating with and sharing administrative duties with the associate project director who was the only fully salaried person associated with the program. In reality, the director's workload increased at no--or very little--increase in pay.

Because of this very typical mix (joint cost) of personnel responsibilities--a situation that can also occur with equipment and other resources--the question: "how much did the program cost?" becomes a very interesting one with several answers. To HEW the cost of the project was obviously the budgeted amount. To the college, the cost was in essence zero unless college resources were consumed and not paid for, e.g., electricity, xerox, supplies, etc. This was not likely since the college received an overhead reimbursement to cover those indirect costs. To the director the project cost can be classically expressed in terms of "benefits lost". To compute the cost however, it is necessary to determine how much an hour of "free" time was worth to the director. To an outside observer, the salient question is "how much would it cost to replicate the program?"

The observers' question is perhaps the most difficult to answer since no two situations are the same. That is, people work at different energy/efficiency levels at pay rates which are unlikely to be the same. Therefore, it is not likely that a program can be replicated at the original cost in a new environment by different people. However, the answer to the observer's question is the one which would have the most meaning to the most people.

In spite of the utility of the answer to the observer's question, it is the answer to the sponsor's question that "satisfies" most people; even though it is highly unlikely that a similar program could be

instituted elsewhere at the budget amount; and even though a considerable amount of resources may have been consumed by the project and not accounted for.

REPORT PLAN AND DEFINITIONS

This report answers the question, "how much did the occupational therapy program cost?" from the observer's point of view. In answering the question, the costs of additional facets of the Occupational Therapy program were determined. Thus, the program funded by the Allied Health grant is viewed in this report as a sub-program rather than the total program. The larger program is referred to in this report as "the occupational therapy program" and it is defined as those courses and educational efforts which were the director's responsibility through the Occupational Therapy Department. The funded portion is referred to as "staff development" since much of the effort at improving relationships with clinical training sites was directed toward in-service training of clinical staff.

The report describes costs according to program life cycle and by program functions.

Life cycle. Life cycle refers to three program phases: Design of the program, investment/production, and operation of the program. These phases are defined below:

Design - Activities related to conceptualization, planning and improvement of instruction, instructional materials, or facilities.

Investment/Production - Purchases of materials, equipment or facilities which are used in the delivery of instruction; and production of class/student materials, e.g., typing/xeroxing handouts.

Operation - Activities associated with the implementation and delivery of instruction...includes pre-class preparation.

Additional detail concerning types of activities that fall within the three life cycles is given in Figure 1.

Reporting costs by life cycles permits the cost of designing a program to be separated from delivery of a program. It also allows identification of the time and effort invested in the instructionally "unproductive" but necessary area of purchasing. Design and Investment in educational programs may be particularly heavy during initial phases. Knowing the start-up costs permits one to estimate what the future instructional costs may be. It also permits estimates of the heavier costs involved in the initial period of a program.

Program Functions. There are two major program functions: Instruction, and Professional Development. The Instructional function is further reduced to a Traditional Instruction function and a Non-Traditional Instruction function. The three functions are defined below:

Professional Development: Professional development activities are directed toward clinical staff who supervise student interns from the Occupational Therapy program. The intent of the activities is to reward staff who receive no pecuniary reimbursement for the supervision, and thereby enhance the relationship between the college and the clinics.

Functional Cost Analysis

ACTIVITY CHECKLIST

DESIGN	INVESTMENT/PRODUCTION	OPERATION
Planning the format, structure, and general content of course or program.	Purchase of hardware or equipment.	Classroom instruction.
Planning and designing specific content and nature of instructional materials to be used.	Purchase of instructional materials (books, paper, media, etc.).	Advising/counseling students.
Selecting from existing instructional materials.	Purchase of office supplies.	Evaluating/assessing students.
Planning required facilities.	Production of materials for class use.	Telling others about course or program.
Personal research to gain knowledge/information.	Cost of renovating facilities.	Instructional support activities (list type of activity and personnel involved).
Developing evaluation plan/procedures.	Rentals.	Pre-class review and preparation.
Evaluating instructional materials (for revision and future use).		

Figure 1

Professional development activities include in-service training via video tapes; consultation with clincial personnel to identify their needs; and serving as an information/resource clearinghouse on such matters as facility design, equipment sources, and sources of available in-service programs.

Traditional Instruction: Classroom instruction of Occupational Therapy students. Two sections of the course, "Developmental Disabilities" and four sections of the course, "Interpersonal Skills."

Non-Traditional Instruction: For Occupational Therapy students who reside beyond a reasonable commuting distance a Developmental Disabilities class of 12 students was held off campus once per week. Another Developmental Disabilities group of 28 students pursued independent study mode and met with the instructors four times, off campus; the final meeting was for an exam.

Life cycle costs are estimated for the total program and for each function. Total program costs are also reported by function. Detailed information concerning personnel and equipment costs are contained in Appendix A.

FINDINGS

Data are reported in Tables 1 through 5. Table 1 reports the total program costs by life-cycle phase; Table 2 reports total program costs by function; Tables 3, 4, and 5 report costs for each function by life cycle phase. The discussion will focus on how the amount of the grant compares with computed costs and how the costs are distributed across functions.

TABLE 1

AGGREGATE PROGRAM COSTS

Institution: New York State Community College

Program: Occupational Therapy

Cycle: Spring 1978 (nineteen weeks)

LIFE CYCLE PHASE / COST CENTER	TOTAL CYCLE	DESIGN	INVEST./PROD.	OPERATION
ADMINISTRATION				
Support Personnel	$ 80	$ -	$ -	$ 80
SUB-TOTAL:	80	-	-	80
INSTRUCTIONAL STAFF				
Faculty	18,445	8,270	1,427	8,748
Support Personnel*	1,536	-	1,536	-
Travel	224	-	224	-
Consultant	500	-	-	500
SOFTWARE	1,252	-	1,252	-
HARDWARE**	756	-	756	-
SUB-TOTAL:				
TOTAL:	22,793	$ 8,270	$ 5,195	$ 9,328
	100%	36.3%	22.8%	40.9%

*Secretarial assistance not covered by grant. The assistance was rendered as typing, etc. of already designed materials for use in classes. Thus the activity was viewed as Investment, production.

**Represents amortized costs (7 years). Cost equals one seventh of total equipment use multiplied by 19/52nds (for 19 week period). Table A-2 in Appendix provides details.

TABLE 2
TOTAL COSTS PER UNIT OF ANALYSIS

Institution: Community College

Program: Occupational Therapy

Cycle: Spring 1978

COST CENTER \ UNIT OF ANALYSIS	TOTAL PROGRAM	TRADITIONAL (127 students)	NON TRADITIONAL (40 students)	PROFESSIONAL DEVELOPMENT
ADMINISTRATION				
Personnel	$ 80	$ -	$ -	$ 80
Other				
SUB-TOTAL:	80	-	-	80
INSTRUCTIONAL STAFF				
Consultant	500	-	-	500
Faculty *	16,755	8,924	5,316	4,205
Support Personnel	1,536	691	768	77
Travel	224	-	224	-
SOFTWARE	1,352	681	221	350
HARDWARE**	756	89	16	651
FACILITIES				
SERVICES				
SUB-TOTAL:	22,793	10,385	6,545	5,783
		45.3%	28.5%	26.1%
TOTAL:	$ 22,793	$ 10,385	6,545	$ 5,863
Cost Per Student		81.77	163.63	

*Extent of involvement:

Project Director - range 36 to 103 hrs/wk., ave.= 64 hrs. per week
Associate Director - range 36 to 86 hrs/week, ave = 52 hrs. per week

**Represents amortized costs (7 years). Cost equals one seventh of total equipment use multiplied by 19/52nds (for 19 week period). Table A-2 in Appendix provides details.

TABLE 3

INSTRUCTIONAL COSTS: Traditional Instruction

(UNIT OF ANALYSIS)

Institution: New York State Community College

Program: Occupational Therapy

Cycle: Spring 1978 (nineteen weeks)

LIFE CYCLE PHASE / COST CENTER	127 Students TOTAL CYCLE	DESIGN	INVEST./PROD.	OPERATION
INSTRUCTIONAL STAFF				
Faculty	$ 8,924	$ 1,837	$ 865	$ 6,222
Support Personnel *	691	-	691	-
SOFTWARE	681	-	681	
HARDWARE **	89	-	89	
TOTAL:	$ 10,385	$ 1,837	$ 2,326	$ 6,222
	100%	17.7%	22.4%	59.9%
Cost per student	$ 81.77			$ 48.99

*Secretarial assistance not covered by grant. The assistance was rendered as typing, etc. of already designed materials for use in classes. Thus the activity was viewed as Investment, Production.

**Represents amortized costs (7 years). Cost equals one seventh of total equipment use multiplied by 19/52nds (for 19 week period). Table A-2 in Appendix provides details.

TABLE 4

INSTRUCTIONAL COSTS: Non-Traditional
(UNIT OF ANALYSIS)

Institution: New York State Community College

Program: Occupational Therapy

Cycle: Spring, 1978 (nineteen weeks)

LIFE CYCLE PHASE / COST CENTER	(40 Students) TOTAL CYCLE	DESIGN	INVEST./PROD.	OPERATION
INSTRUCTIONAL STAFF				
Faculty	$ 5,316	$ 2,645	$ 145	$ 2,526
Support Personnel*	768	-	768	-
Travel	224	-		224
SOFTWARE	221	-	221	-
HARDWARE**	16	-	16	-
TOTAL:	$ 6,545	$ 2.645	$ 1,150	$ 2,750
	100%	40.4%	17.6%	42.0%
Cost per student	$132.90			$68.75

*Secretarial assistance not covered by grant. The assistance was rendered as typing, etc. of already designed materials for use in classes. Thus the activity was viewed as Investment, Production.

**Represents amortized costs (7 years). Cost equals one seventh of total equipment use multiplied by 19/52nds (for 19 week period). Table A-2 in Appendix provides details.

TABLE 5

INSTRUCTIONAL COSTS: Professional Development

(UNIT OF ANALYSIS)

Institution: New York State Community College

Program: Occupational Therapy

Cycle: Spring, 1978 (nineteen weeks)

LIFE CYCLE PHASE / COST CENTER	TOTAL CYCLE	DESIGN	INVEST./PROD.	OPERATION
INSTRUCTIONAL STAFF				
Faculty	$ 4,205	$ 3,788	$ 417	$
Support Personnel *	77	-	77	
Consultant	300	-	500	
SOFTWARE	350	-	350	
HARDWARE **	651	-	651	
TOTAL:	$ 5,783	$ 3,788	$ 1,995	$
	100%	65.5%	34.5%	

Cost per tape - $578.30

Cost per viewer - $321.27

*Secretarial assistance not covered by grant. The assistance was rendered as typing, etc. of already designed materials for use in classes. Thus the activity was viewed as Investment, Production.

**Represents amortized costs (7 years). Cost equals one seventh of total equipment use multiplied by 19/52nds (for 19 week period). Table A-2 in Appendix provides details.

Grant vs. Reality

The Allied Health grant was for the amount of $41,118. If this were to be distributed equally over 12 months, the 19 week period on which this study focuses would be costed at $15,024. However, this figure contains equipment costs at full price whereas in this report the equipment is depreciated. Treating the grant in the same manner results in a "total" grant of $27,436 [$41,118 - (.875 x 15,637)].[1] The 19 week period would then be costed at $10,014 (27,436 x .365).[2]

The grant was ostensibly for the purpose of improving relations between the college and clinical settings. It was also quite clearly for the purpose of funding a professional to assist in teaching existing courses and it also intended that the equipment be used by other college faculty. Therefore, the $10,014 grant portion should not be compared with total program costs (Table 1) nor with costs of the Professional Development function (Table 5). Rather it should be compared with Professional Development plus certain aspects of several functions. The appropriate costs for comparison appear below:

Professional Development (see Table 5)	$ 5,783
Associate Directors Salary for other functions	4,694
All Hardware	105
Travel	224
Software	559
	$ 11,405

[1] $15,637 represents the cost of equipment; .875 represents seven years of future depreciation (7/8ths.)

[2] 19 weeks - .365 x 52 (1 yr.)

There are several tongue-in-cheek ways of looking at thes two costs ($10,014 and $11,405): either the grant was insufficient for the task, or the grantor got a lot for its money, or the college lost. In reality of course, nothing unexpected occurred, rather the data supports the notion that what appears on the budget is not necessarily the project cost. Resources required by the Professional Development function of the program included a portion of the project director's salary, miscellaneous secretarial and administrative involvement, and equipment not identified in the grant (e.g., typewriter). It should be noted that an equipment "bargain" of $4,558 (reduced price of a TV camera) increased the amount of money available to other grant categories by approximately $1,400. Not all of the additional resources consumed for the Professional Development function are revealed due to this "cushion" (to illustrate: the project director salary attributed to Professional Development was $1,967; more than the $1,411 difference between $10,014 and $11,405).

Instructional Function Costs

Approximately 75% of these costs are associated with the instructional functions, with over half of the amount attributable to traditional instruction. However, the cost per student is less for traditional instruction than for non-traditional instruction; in fact, half as much ($81.77 vs. $163.63, see Table 2). The efficiencies of various student enrollments are illustrated in Figure 2. In this figure, the costs are current operations costs only; indicating the approximate pupil cost

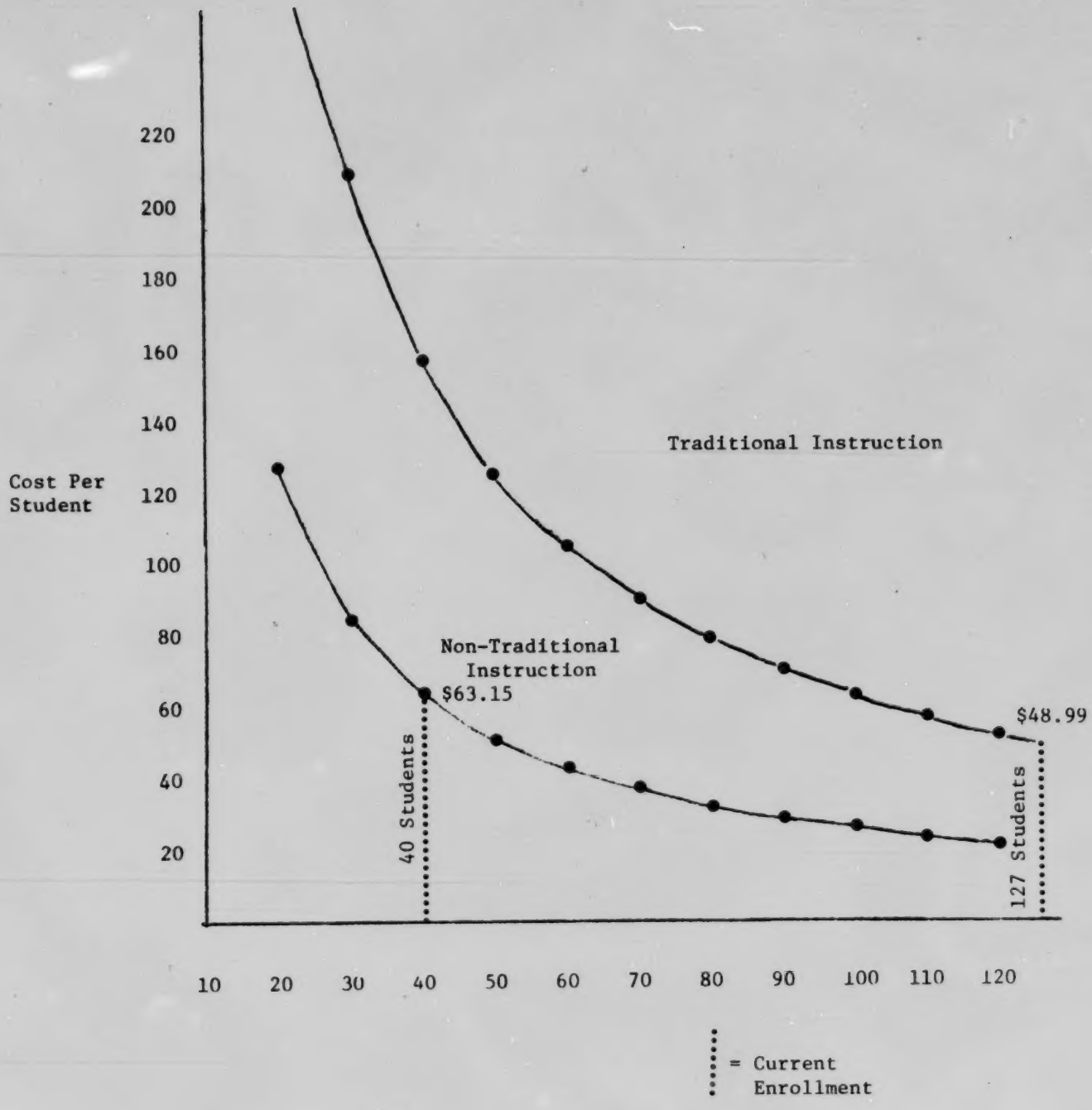

Figure 2. Instructional costs per student at various levels of student enrollment

of an established program with no major design activity. The figure indicates that the Traditional Instruction function has an enrollment of about the optimum level. However, there is a possibility of significantly increasing the efficiency of the non-traditional function.

Students in the non-traditional mode covered the same material as their traditional counterparts. They took the same exam and performed as well and perhaps better. However, cost effectiveness cannot be measured because it is uncertain whether the performance measures are criterion measures. The cost per student can be more appropriately viewed as an efficiency measure, to be compared with other efficiency measures.

The difference in cost per student is probably not a major concern to the college unless there is a need to expand one course or the other. Then there might be a need to investigate points at which efficiencies could be increased. If 80 students were enrolled in the Non-Traditional program, the total costs would be the same as for the 127 traditional students. However, it is also possible that additional costs may accrue as students are added. Incremental costs and savings associated with adding students to either program could be estimated through a simple procedure.

The cost per student may be of greater interest to outsiders interested in developing a similar program. It suggests the importance of identifying a definite student need prior to program implementation in order to assure efficient enrollment.

Investment/production costs appear high for both instructional functions(@18% and 22%) and this may be attributed to the amount of time devoted by faculty and support personnel to the production of class materials.

Design costs also appear high for the non-traditional group. Since this was a first effort with this type of instruction and much pre-packaging was necessary, these costs are understandable. Both design and investment costs tend to diminish over time.

Professional Development Costs

The direct benefits of the Professional Development program accrue to clinical staff, not students. Therefore, there are no operation costs as defined by this study. However, it might be appropriate to view the design costs as operation costs since they reflect what is done in order to implement the program. On the other hand it may be useful to identify specific activities as either operations or design activities.

Program outputs have been ten video tapes, on site meetings with clinical staff, and responses to phone/mail queries.

Appendix B contains two responses to a questionnaire concerning the showing of two of the ten tapes to clincial staff. Eighteen people viewed the tapes and those tapes will be requested for use again. The efficiency measures shown at the bottom of Table 5 indicate the program is costly. However, two caveats should be noted: these measures are premature (it was only a 19 week period, a start-up period;

furthermore, more showings will occur and more tapes will be produced) and they are inappropriate as measures of benefit--they are indicators of efficiency only.

The appropriate benefit with which to compare the costs of the program is the improved relationship between the college and professional staff. Identifying appropriate measures for this benefit would be very difficult. It would appear that, for the time being, qualitative judgments of the importance of Professional Development services will have to suffice as a "measure" of their worth. This might be accomplished by comparing the goals of this function with college/county goals.

Design Costs

The unit cost (whatever the unit) of each function, especially Professional and Non-Traditional Instruction, can be reduced dramatically if one can accept the notion that Design, like Investments is an activity that has benefits over time.

Equipment and hardware is depreciated over time--in part to reduce the impact of heavy expenditures on output efficiencies. The same could be legitimately done with Design activities if there is need to defend a program's initial cost.

For example, assume that the $3,788 Design efforts for Professional Development had benefit over a five year period; that is, the clearing-house structure, the tapes, the consultant's assistance, etc., are useful for five years before they are revised or added to. In such a case the cost attributable to the 19 week period would be $757.

If design costs are going to decrease, this would be a reasonable approach, however they could build up, and any initial advantage might be eliminated.

Faculty Involvement

The Director and Associate Director have invested a large number of hours and much energy in the program, averaging 64 and 52 hours per week respectively. This presents a problem for potential implementers of a similar program since it's unlikely that an equally ambitious staff could be found. If the same amount of work was to be performed by people who worked 45 hours per week at a salary equal to current staff, and if the same number of hours were required in order to implement the program in a 19 week period, additional staff would be required and the cost would be approximately $4,000 higher.

SUMMARY

Findings indicate that the cost of the program is higher than would be expected from a simply pro-rating the amount of the grant over the period being examined. Also, total Design costs (36%) and Investment/ Production costs (23%) are quite high.

From the college's point of view, the expanded Occupational Therapy Program was achieved for a cost of approximately $1,400 for the nineteen week period. For this investment they received $15,637 worth

of equipment and some "P.R." of undetermined value. Presumably the colleges' cost will increase after the period of the grant, but the major increase will be the amount of one FTE instructor's salary. The instructor will be needed to handle a larger student enrollment and to maintain the outreach effort.

From the observer's point of view, the nineteen week program could be initiated for an account ledger amount (in which investments are amortized) of approximately $22,800 plus $4,000 for additional manpower. Of course, each observer could plan incremental savings or costs. For example, the observer might reduce equipment costs by using one video camera/recorder unit; they might also expect their personnel to be as devoted to the task as the personnel of the program reported herein, and thus "save" $4,000. Perhaps salary levels and skill levels of personnel would vary, for example, media technicians rather than instructional personnel might perform most of the design (media production) activities.

APPENDIX A

Procedures for Arriving at Resource Costs

Personnel Costs

The period covered by this study is 19 weeks (1/16/78 to 5/26/78). Full-time personnel involved in this study had either a ten month or a twelve month contract. The ten month contract is computed by the college as 21 pay periods (42 weeks) although the salary may be distributed over a full year; the twelve month contract is 26 pay periods (52 weeks). There is no officially recognized vacation time. The study period comprises 0.452 of a ten month contract and 0.365 of a twelve month contract. These factors and the Fringe Benefit (39%) are used to calculate personnel costs reported in Table A-1.

TABLE A-1

Personnel Costs

Position Title	Salary $ FB	Factor	Salary for Project
Project Director	$ 22,908	0.452	$ 10,354
- " -	1,380	.50	690
Associate Project Coordinator	17,100	0.365	6,242
Faculty: Non traditional instruction	1,159	1.00	1,159
Secretary	14,026	0.30* X 0.365	1,536
Consultant	500	1.00	500
Other**	-	-	80
TOTAL			$ 20,561

* Approximately 30% of secretary's time applied to program.

** See paragraph in text, below.

It is reasonable to assume that "other" personnel costs are incurred because of the program. For example, the A-V Services director is involved when providing equipment for the project director's classes. Furthermore, the Allied Health project account is supervised through the business office and proposals need to be signed by college administrators. The sum total of involvement may have been less than one man day, and in any event, is not likely to exceed two man days. At the rather high salary of $15,000 one man-day would be worth approximately $80 (including Fringe Benefits).

Equipment Costs

Studies have shown that the effort required to attach life cycle costs to equipment and hardware is very onerous. These studies have also shown that hardware costs for design or operation purposes are usually considerably less then one percent of the total design/operation costs unless expensive equipment is involved or the program is relatively small. For these reasons all hardware and equipment costs are viewed as investments and assigned to investment/production rather than to program design or operation.

Hardware and equipment costs are expressed as depreciation amounts rather than as lump sums. These costs are attributed to the specific program subunits for which the equipment or hardware was used, in proportion to use. In this report, most of the equipment was used for Professional Development.

The manner in which hardware and equipment costs were derived is detailed in Table A-2.

TABLE A-2

EQUIPMENT/HARDWARE COSTS

ITEM	COST BASE	ANNUAL[1] RATE x .365	UTILIZATION BREAKDOWN (%) BY SUB PROGRAM[2]			COSTS BY SUB PROGRAM		
			T	N	D	T	N	D
35 mm. Camera	240	10.95	75%	0	25	8.21	0	2.74
Overhead Projector	349	15.92	10%	0	0	1.59	-	-
Filmstrip Projector	195	8.90	(1hr)	(1hr)	0	-	-	0.80
16 mm. Film Projector	522	23.82	33%	0	0	7.86	-	-
TV Camera #1	5,800	264.63	0	0	100	-	-	264.63
TV Camera #2	1,242	56.67	0	0	100	-	-	56.67
Video Cassette Recorder #1	3,300	150.56	35%	0	50	52.70	-	75.28
Video Cassette Recorder #2 (Portable)	2,000	91.25	0	5	95	-	4.56	86.69
Video Monitor #1	600	27.38	35%	0	50	9.58	-	13.69
Video Monitor #2 (Portable)	420	19.16	0	5	95	-	0.96	18.20
Camera Tripod	300	13.69		0	100	-	-	13.69
Storage Case	275	12.57	0	0	100	-	-	12.57
Carrying Case	75	3.42	0	0	100	-	-	3.42
TV Equip. Carrier	425	19.39		0	100	-	-	19.39
Lighting Kit	675	30.80	0	0	100	-	-	30.80
Mike/Cable	50	2.28	0	0	100	-	-	2.28
Typewriter #1	400	18.25	33%	33	33	6.08	6.08	6.09
Typewriter #2	540	26.64	13%	15	2	3.46	4.00	0.53
Batteries (monitor)	275*	25.09	0	0	100	-	-	25.09
Batteries (camera)	200*	18.25	0	0	100	-	-	18.25
TOTAL COSTS[3]	-	840.62	-	-	-	89.48	16	650.81

[1] Depreciation computed by straignt line method, 8 yr. life. Nineteen weeks = 0.365

[2] Sub-Program: T = Traditional, N = Non-traditional, D = Professional Development
When per cent sums equal 100 it indicates total use by program.
When per cent sums are less than 100 it indicates that other programs make use of the item.

[3] Other programs utilize $84.73.

* Items so marked are depreciated on the basis of a 4 yr. life.

APPENDIX B

Questionnaire for Videotape: Bliss Symbolics

1. How did you learn about the tape? Searching for information for inservice training on Blissymbolics . Gloria Sterns notified me that she had a video on the subject which we could view. Have not had inservice but will request use oOf tape at that time.

2. To what group was the tape shown? Three people - an Assistant Speech Pathologist, and two Certified Occupational Therapy Assistants.

3. How many viewers were there? Only three at this time.

4. What did you wish the viewers to gain from the tape? added resource materials for inservice on Bissymbolics to be given to professional and non-professional staff so that we may implement a complete program soon.

Also new ideas to use in our present programming.

5. How well do you believe this goal (your response to question #4) was attained and what is the basis for this belief? The tape was aworthwhile tape for us to view. It showed us programming in the Buffalo area which we were not aware of and the various techniques used for the pogramming. It also encouraged us to personally view the taped program on a recent visit to the Buffalo area.
We are presently trying some of the ideas in the tape with our programming.

6. Please give your impressions about how the viewers liked the tapes (include any comments they may have made). The tape was believed to be good and it has been decided that we will use it during the course of our inservice. If we did not feel it was worth using we would not.

Thank You For Your Cooperation

Please return this form to:

Dr. Albert Beilby
13 Stone Hall
Cornell University
Ithaca, New York 14853

Questionnaire for Videotape: Communication with Geriatric Patient

1. How did you learn about the tape? I suggested we make the tape as a joint effort between OT. & NURSING

2. To what group was the tape shown? NURSING Home STAFF

3. How many viewers were there? Approx. 15 (will be shown later in summer)

4. What did you wish the viewers to gain from the tape? an understanding of how their reactions effect patients behavior and how what we think we're communicating is not what is always received and understood.

5. How well do you believe this goal (your response to question #4) was attained and what is the basis for this belief?
I think the staff that saw the tape understood what was said & demonstrated due to their subsequent attempt to be more sensitive to what pts are truly saying

6. Please give your impressions about how the viewers liked the tapes (include any comments they may have made).
thought it was meaningful to see what their behavior looked like to non-professional people.

Thank You For Your Cooperation

Please return this form to:

Dr. Albert Beilby
13 Stone Hall
Cornell University
Ithica, New York 14853

PART II

THE COST STUDIES

(Continued)

Study No. 2 - College Preparatory Chemistry

The second study is considerably different from the first. The common thread is the functional cost model which was used as the study framework. In this case, most of the work had been done during the preceding 5 years. The analyst was invited to examine the five year costs of the program because outside funding was coming to an end and the project director wanted to know how to describe to others what the $200,000+ investment over that five year period had been achieved.

At the beginning of the study there was no intention to do anything other than restructure the description of program costs. However, it became clear that the situation presented an opportunity to test the utility of the cost model by calculating program benefits.

Data were collected via examination of financial records and lengthy interview/work meetings with the project director.

In the preparatory chemistry study, "resource consumption" is the major descriptive term used to describe the cost procedures employed. The terms Design, Investment, and Operation were not as fully emphasized and defined as in previous work, and "life-cycle" was not mentioned in the report. The absence of these terms from the report appears to have created no problems.

Major conclusions contained in the cost-benefit study are:

1. The program has not been a cost to the college, but has contributed approximately $13,000 above combined administrative and faculty costs. That is, while the college provided approximately $91,000 to support the funded program over the five year period, the grants supported faculty

salaries by approximately $104,000. In this trade-off of costs, the college benefited.

2. The program provides on-going benefits of approximately $10,000 by attracting students to the program and through student retention.

3. The efficiency (cost per student) can be increased if other programs adopt the program's methods and utilize the hardware.

4. A learning lab manager is required by the program. The lab managers salary is about equal to the value of on-going benefits quantified in Conclusion 2, above.

The detailed report of the preparatory chemistry program follows. Implications drawn from the conduct of the study are discussed in Part III, which immediately follows the study.

Cost Benefit Analysis of a Two-Year College Preparatory Chemistry Program

Part I
Introduction

Determining costs of educational programs is a complex task. It is necessary to conduct interviews and collect information about how key individuals spent their professional time. It is also necessary to identify and determine the cost of resources entering into a program. Then, if it is desirable to divide the program into sub-units, the efforts and costs must be allocated to the various units. Overall, educational costing requires a systematic, logical, consistent examination of cost data.

There are many ways to describe and cost a program. Assumptions must be made to guide the analysis, and amortization rates must be determined if amortization is used. This report is one analyst's view of a particular program. Other analysts might view the program differently, thus, it is critical that all assumptions be spelled out and that all computation procedures and data sources be clearly identified. While end results of several analytical approaches would probably not be greatly different, a slightly different approach gives rise to fears of great disparity and end results. A few trial calculations will usually be enough to allay these fears.

The Program

The program being examined in this study is Programmed Response Instructional Support Modules (PRISM).

The initial purpose of PRISM was to instruct students who have not had high school chemistry--or satisfactory grades in high school chemistry--in Preparatory Chemistry in order that they can enroll in regular college chemistry courses. PRISM is used in this study to refer to all five years of the program even though the name was formally adopted only two years ago.

PRISM has the possibility of three instructional modalities:

Instructional Support System (ISS) - independent slide/tape modules which are monitored and graded via computer.

Student Response System (SRS) - a computer monitored and graded response system for class use which permits instructor-student interaction.

IS/RS - both of the other modalities in concert.

The "mainstream" PRISM program consisted of "ISS only" the 1st and 2nd years and "IS/RS" for the last three years. The SRS and ISS modalities were available and used by non-PRISM instructors. This "non-PRISM" use of system components complicated the cost study by requiring complex cost allocations.

The plan of the study is to report year-by-year costs, determine benefits to other programs which use PRISM components, and to estiamte benefits to the college in terms of student income. Calculation of benefits will be limited to those most easily quantified and which benefit the college only. In this respect, this study is a benefit analysis of limited scope. Furthermore, no in depth cost projections are made. Neither have

the Chemical laboratory costs been included in this study since they are similar to chemistry lab courses everywhere and not determined by PRISM's instructional strategies. To have included this conventional laboratory cost would have diluted the clarity of the costs of PRISM's non-instructional aspect. The lab exercises were experiments, they were required of all students, so there was no direct observable link between the learning system and the chemistry labs which would have impacted on the cost of the labs.

Part II

Annual Costs of PRISM

1973 - 1978

This section contains a year-by-year display of costs associated with PRISM. For each year, a table of costs is presented. These costs are viewed from three perspectives: 1) a resource consumption view--in which all resource inputs to the program are identified and quantified in terms of dollars, 2) a grant view--in which grant support for individual resources is presented; and, 3) the college's view of what the program costs. It should be noted that in the latter case the major costs are for administrative overhead and faculty salaries. Furthermore, even had the grant not been available, faculty salaries would have been paid for instruction in courses now considered to be PRISM courses. Therefore, the exceptional costs which the college supports are administrative costs.

For each year but the first, two tables of costs are given. The first table in each case is the aforementioned display of costs from three perspectives. The second table expands in the Resource Consumption view by attributing costs to major instructional modalities (IS/RS, ISS, and/or SRS). The absence of a second table for Year One is due to the fact that all costs for that year were considered to be for Design; and no further reduction of costs was necessary.

Costs are further broken out for each modality according to whether they were for the purpose of Design, Investment, or Operation. Analyzing the costs of these functions separately permits the cost of investment and

design of a program be separated from delivery of the program. This is useful in making future projections of costs and in assigning benefit to other areas.

After year three, neither "ISS only" nor "SRS only" were part of the mainstream PRISM program. Nevertheless, costs are attributed to ISS and SRS for years two through five in order to determine the value of benefits accruing to courses which utilize some subset of the PRISM system. The sections of Part II consist of 1) a discussion of how investment and administrative costs were determined, 2) the display of annual costs, 3) a summary of annual costs, and 4) a discussion of college support costs.

Investment Costs and Administrative Costs

Prior to examining the annual costs of PRISM, it may be helpful to understand how investment costs are displayed and how administrative costs were determined.

Investment Costs

Investment costs are expressed as amortized hardware (10 years), software (4 years), and facilities costs (5 years). Since these costs were covered by grants it is reasonable to question why amortization was selected over lump sum cost; particularly since--for continuity, future cost reports would need to report as costs, items which have already been paid for by outside sources.

The principle reasons for showing amortized investment costs is that it provides a useful alternative statement of project costs to outsiders who may wish to begin their own similar program but who lack outside support. Amortization expresses costs more in line with current college accounting practices.

There are other advantages to amortizing investment costs: first, it reduces the impact of high cost items on the apparent cost of the project; second, it portrays the timelines of resource consumption more accurately.

The reader should keep in mind, that *the investment costs of PRISM have been almost totally covered by grants and thus are not current real costs to the project.* In fact, these "costs" are presented in the last section of this chapter as benefits shared by other programs. Any projections which purport to show costs to the college for maintenance of the program should not include these investments.

Administrative Costs

Administrative costs are frequently clustered together as "Overhead", and are usually expressed as a percent of the project budget. For purposes of this study, administrative costs have been separately computed according to the amount of administrative effort required by PRISM and on the basis of an average salary. The administrative elements, effort, and estimated salary are listed in Table 1.

TABLE 1

ADMINISTRATIVE COSTS OF PRISM

Cost Category	Est. Effort	Est. Annual Rate (200 days) Per Project Year				
		1	2	3	4	5
Personnel (Grant Officer)	1 day/yr.	13,500	14,450	15,250	16,750	17,500
Personnel (Bookkeeper)	2 wks./yr.	10,000	11,420	12,050	13,280	14,000
Personnel (Purchasing Agent)	1 day/yr.	10,000	11,420	12,050	13,250	14,000
Personnel (Accts. Payable)	1 week/yr.	6,700	7,100	7,500	8,250	8,500
Personnel (Dept. Charmn, Div. Dean Vice Presidents)	1 day/yr. (combined)	22,000	23,500	24,750	27,250	28,000
Other (Electronic Technicians)	yr 3=25 hrs. yr 4=25 hrs. yr 5=100hrs.	x	x	13,400	14,750	15,000
Other (Technical Services)	1 day/yr.	x	x	12,050	13,250	14,000
Other (Facilities Renovation)	yr 1:4 man days yr 2:6 man days yr 5:10 man days	6.50/hr.	7.50/hr.	x	x	$9/hr

Note: Because of sensitivity of determining these administrative costs, some of the estimates were made by the Project Director and cost analyst; however, most estimates involved the principals directly. Estimates are believed to exceed actual demands.

Table 1 does not show the following administrative costs: Payroll, Personnel, Physical Plant Maintenance, Utilities, Debt Interest. These categories are omitted because they are costs which would be incurred at the administrative level even if PRISM did not exist. Admittedly, paperwork had to be processed at some point by Payroll and Personnel to hire and pay project staff who may not have otherwise been hired by the college. However, due to routinization and mechanization of this type of data processing it is doubtful that a single man day of these combined services has been utilized during PRISMs five years of existence.

Display of Annual Costs

The tables which follow provide a year-by-year display of PRISM costs. A brief description of the year's highlights precedes the display of costs for each year.

Appendix A describes how costs were determined for each table.

A summative discussion of data portrayed in the tables is given in the section following the tables.

YEAR 1 - 1973/74

During its first year PRISM was characterized largely by design/development efforts. The general goal of the project was to produce self instructional media modules. Three modules, and five learning stations became available for spring and summer classes. There was no computer capability.

STAFF: consisted of the Director and a part-time secretary-typist. Various media personnel were also involved.

STUDENT ENROLLMENT:

Prep. Chem: Two classes (Spring, Summer) 29 students

Dev. Chem: One class (Spring) 33 students

Projects costs are displayed in Table 2

Major Hardware Purchases were:

5 caramates
1 telex recorder

TABLE 2

PRISM COSTS - Year 1

Cost Category	Resource Consumption	From Grant	College Support
Administration			
Personnel	$ 1,138	8% of	x
Other	208	grant	x
Subtotal	$ 1,346	$ 690	+ 684
Instructional Staff			
Faculty	3,913	3,802	+ 111
Support Personnel*	960	960	0
Consultant	136	136	0
Media Services	2,277	2,216	+ 61
Software	62**	173	+ 69
Hardware	247**	2,479	0
Subtotal*	$ 7,595	$ 9,766	$ 241
TOTAL	$ 8,941	$ 10,456	$ + 897

Note: See Appendix A for explanation of derivation of costs.

*Because of different treatments of Software and Hardware, cols. 2 and 3 will not equal col. 1

**These amounts represent amortized costs.

YEAR 2 - 1974/75

This was the first, full year for the project. Instruction occurred via lecture and the ISS modality; however, during this year initial investigation of, and planning for a Student Response System occurred. The major developmental activity was software development. There was no computer capability.

ISS MODULES AVAILABLE: 10 for fall; 15 for spring and summer.

STAFF: Project Director (lectured and developed modules).
Assistant Director (faculty; supervised ISS learning lab), secretary-typist (part-time).

STUDENT ENROLLMENT: Total - 154 students distributed as follows:

Prep Chem: (six classes) Fall-55, Spring-26, Summer-34
Dev. Chem: (one class) Spring-29

Project costs are displayed on Tables 3 and 3A

TABLE 3

PRISM COSTS - Year 2

Cost Category	Resource Consumption	Grant	College
Administration			
Personnel	$ 1,264	(8%) of	x
Other	457	Grant	x
Subtotal	1,721	$ 1,064	$ + 687
Instructional Staff			
Faculty	26,359	6,674	19,685
Support Personnel	480	480	0
Travel	48	48	0
Consultant	150	150	0
Media Services	7,801	7,801	220
Software	317**	1,019	0
Hardware	248**	0	0
Subtotal*	$ 35,403	$ 16,172	$ 19,905
TOTAL*	$ 37,134	$ 17,236	$ 20,562

*Because of different treatments for Software and Hardware, cols. 2 and 3 will not equal col. 1

NOTE: See Appendix A for derivation of figures

**These amounts represent cumulative amortized costs

TABLE 3-A

INSTRUCTIONAL COSTS - Year 2

RESOURCE CONSUMPTION APPROACH

Cost Category	Total	ISS (154 Students)			SRS (no students)
		Design	Invest.	Operation	Design Only*
Faculty	$ 26,359	$ 6,678	$ 0	$ 18,488	$ 1,193
Support Personnel	480	456	0	0	24
Travel	48	48	0	0	0
Consultant	150	75	0	0	75
Media Services	7,801	7,801	0	0	0
Software	317	0	317	0	0
Hardware	248	0	248	0	0
TOTAL	$ 35,403	$ 15,058	$ 565	$ 18,488	$ 1,292
% (Based on ISS Total cost of $34,111)	-	44%	2%	54%	-
Cost Per Student	N.A.	97.78	3.67	120.05	N.A.

Total costs per ISS Student: $221.50

NOTE: See Appendix A for derivation of figures

*To be used to compute benefits (Tables 9 & 10)

YEAR 3 - 1975/76

In the third year of operation, the SRS modality was placed in operation. This component was integrated with lectures and with the ISS modality to provide the ISS/RS instructional modality.

ISS MODULES AVAILABLE: 26 each semester.

STAFF: same as second year.

STUDENT ENROLLMENT: Total - 168 students distributed as follows:

Prep. Chem: (seven classes) Fall-40; Spring-39, Summer-40
Dev. Chem: (one class) Spring-19
Nursing/x-ray Tech: (one class) Fall-30

Project costs are displayed on Tables 4 and 4A.

Major Hardware Purchases

32 seat SRS classroom
5 AVR's
1 computer
2 printing terminals

TABLE 4

PRISM COSTS - Year 3

Cost Category	Resource Consumption	Grant	College Support
Administration			
Personnel	$ 1,334	$ 0	$ 1,334
Other	343	0	343
Subtotal	$ 1,677	0	$ 1,677
Instructional Staff			
Faculty	24,418	9,369	15,049
Support Personnel	3,458	3,357	101
Travel	389	389	0
Consultant	3,787	3,787	0
Media Services	4,748	4,695	53
Software	2,198**	7,533	0
Hardware	6,743**	64,909	0
Subtotal*	$ 45,741	$ 94,039	$ 15,203
TOTAL	$ 47,418	$ 94,039	16,880

*Because of different treatments of software/hardware, cols. 2 and 3 do not equal col. 1

NOTE: See Appendix A for derivation of figures.

**These amounts represent cumulative amortized costs.

TABLE 4-A

INSTRUCTIONAL COSTS - Year 3

RESOURCE CONSUMPTION APPROACH

Cost Category	IS/RS - 168 Students			ISS	SRS
	Design	Invest.	Operation	Invest.	Invest.
Faculty	$ 7,052	$ 0	$ 17,366	NA	NA
Support Personnel	1,141	0	2,317	NA	NA
Travel	389	0	0	NA	NA
Consultant	3,787	0	0	NA	NA
Media Services	4,748	0	0	NA	NA
Software	0	2,198	0	$ (2,198)	NA
Hardware	0	6,743	0	$ (1,270)	$ (1,770)
TOTAL	$ 17,117	$ 8,941	$ 19,683		
%	37%	20%	43%		
Cost per student	$ 101.89	$ 53.22	$ 117.16		
TOTAL IS/RS Cost Per Student			$ 272.27		

The amounts in parens are investment costs attributable to the specific modality. These amounts will be used in future years to calculate cost and benefits when students are taught via those modalities alone. For this year the costs are absorbed by IS/RS.

NOTE: See Appendix A for derivation of figures

YEAR 4 - 1976/77

For the first time, PRISM program components were used outside the program. The SRS modality was used by other faculty during lecture periods. Software development was the major instructional activity.

ISS MODULES AVAILABLE: 41 each semester.

STAFF: Project Director (lectured and developed modules).

Additional Faculty: one (taught a preparatory Chemistry course).

Assistant Director: (non-faculty, Supervised ISS learning lab).

Secretary/typist: (part-time)

STUDENT ENROLLMENT: Total 312 - distributed as follows:

IS/RS: Prep. Chem - (seven classes) Fall-57; Spring-37; Summer-49

Dev. Chem - (one class) Spring-15

Nursing/Respiratory therapy (one class) Fall-26

Dental Hygiene - (two classes) Fall-60

SRS: Nursing - (one class) Fall-35

Mortuary Science - (one class) Spring-13

Environmental Technology - (one class) Summer-20

Project costs are displayed on Tables 5 and 5A

TABLE 5

PRISM COSTS - Year 4

Cost Category	Resource Consumption	Grant	College Support
Administration			
Personnel	$ 1,468	$ 0	$ 1,468
Other	377	0	377
Subtotal	$ 1,845	0	$ 1,845
Instructional Staff			
Faculty	25,464	0	25,464
Support Personnel	7,508	7,508	0
Travel	140	140	0
Consultant	1,355	1,355	0
Media Services	10,795	10,043	523
Software	2,651**	1,815	0
Hardware	6,738**	0	0
Subtotal*	$ 54,651	$ 20,861	$ 26,216
TOTAL	$ 56,496	$ 20,861	$ 28,061

*Because of different treatments of software/hardware, cols. 2 and 3 do not equal col. 1

NOTE: See Appendix A for derivation of figures

**These costs represent cumulative amortized costs

TABLE 5-A

INSTRUCTIONAL COSTS - Year 4

RESOURCE CONSUMPTION APPROACH

Cost Category	IS/RS - 244 Students			SRS* - 68 Students	
	Design	Invest.	Oper.	Design	Invest.
Faculty	$ 7,297	$ 0	$ 18,167	$ 0	$ 0
Support Personnel	41	0	7,467	0	0
Travel	140	0	0	0	0
Consultant	1,057	0	0	298	0
Media Services	10,795	0	0	0	0
Software	0	2,651	0	0	0
Hardware	0	5,941	0	0	787
TOTAL	$ 19,330	$ 8,592	$ 25,634	$ 298	$ 787
%	36%	16%	48%		
Cost Per Student	$ 79.22	$ 35.21	$ 105.06		
TOTAL IS/RS Cost Per Student		$ 219.49			

NOTE: See Appendix A for derivation of figures

*No operation costs since faculty were not PRISM faculty - these costs will be used to calculate benefits (Tables 9 & 10)

YEAR 5 - 1977/78

In the fifth year of development, both the SRS and ISS components were used outside the PRISM program. The ISS modality employed either commercial materials or those developed for PRISM.

ISS MODULES AVAILABLE: 51 each semester

STAFF: Same as fourth year of program

STUDENT ENROLLMENT: 428 students distributed as follows:

IS/RS: Prep. Chem (eight classes) Fall-74; Spring-51; Summer-36
Dev. Chem (one class) Spring-19
Nursing/Resp. Therapy (one class) Fall-32
Dental Hygiene (two classes) Fall-62
Mortuary Science (one class) Spring-19

SRS: Nursing/x-ray Technology (one class) Fall-32
Environmental Tech. (one class) Spring-16

ISS: Instrumental Analysis (one class) Spring-47*
Med. Lab Technician (one Class) Spring } 35
Math and Science (one class) Spring }
EOC 5 students

Project costs are displayed on Tables 6 and 6A

Major Hardware Purchases:
15 caramates

*Used commercial materials.

TABLE 6

PRISM COSTS - Year 5

Cost Category	Resource Consumption	Grant	College Support
Administration			
Personnel	$ 1,537	$ 0	$ 1,537
Other	2,193	0	2,193
Subtotal	3,730	$ 0	$ 3,730
Instructional Staff			
Faculty	24,682	4,064	20,618
Support Personnel	14,330	13,695	635
Travel	162	162	0
Consultant	4,058	4,058	0
Media Services	8,925	8,925	0
Software	4,632**	8,157	0
Hardware	10,124**	33,860	0
Facilities	200	2,000	0
Subtotal*	$ 67,113	$ 74,921	$ 21,253
TOTAL	$ 70,843	$ 74,921	$ 24,983

*Because of different treatment of hardware/software, cols. 2 and 3 do not equal col. 1

NOTE: See Appendix A for derivation of figures

**These amounts represent cumulative amortized costs

TABLE 6-A

INSTRUCTIONAL COSTS - Year 5

RESOURCE CONSUMPTION APPROACH

Cost Category	IS/RS - 257 Students			SRS*-48 Students		ISS - 30 Students			ISS Hardware only-47 students		
	Design	Invest.	Oper.	Design	Invest.	Design	Invest.	Oper.	Design	Invest.	Oper.
Faculty	$ 7,051	$ 0	$ 17,631	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Support Personnel	957	0	10,744	0	0	0	0	1,029	0	0	1,600
Travel	162	0	0	0	0	0	0	0	0	0	0
Consultant	2,719	0	0	527	0	325	0	0	487	0	0
Media Services	8,033	0	0	0	0	892	0	0	0	0	0
Software	0	4,169	0	0	0	0	463	0	0	0	0
Hardware	0	8,062	0	0	608	0	569	0	0	886	0
Facilities	0	154	0	0	0	0	18	0	0	28	0
TOTAL	$18,922	$ 12,385	$ 28,375	$ 527	$ 608	$ 1,217	$ 1,050	$1,029	$ 487	$ 914	$1,600
%	32%	21%	47%								
Cost per student	$ 73.63	$ 48.19	$ 110.40								
TOTAL COSTS	$59,682 ($232.23 per Student)			$1,176		$3,401			$3,001		

*SRS had no operation costs since PRISM personnel were not involved in instruction.

NOTE: See Appendix A for derivation of figures

Discussion of Annual Cost Tables

Cost Per Student

Table 7 reports the total and per student costs of the mainstream PRISM courses for each year of operation. Although annual costs have consistently increased, the per student cost exhibits a general downward trend as more students are enrolled, thereby indicating the efficiency of system use.

TABLE 7

Yearly Total and Per Student Costs of PRISM

Year	Total PRISM Costs *	Total Costs Per Student	Design & Invest. Costs per Student	Operation Costs Per Student
1 - 1973/74	$ 7,595	N.A.	N.A.	N.A.
2 - 1974/75	35,403	$ 221.50	$ 101.45	$ 120.05
3 - 1975/76	45,741	272.27	155.11	117.16
4 - 1976/77	53,556	219.49	114.43	105.06
5 - 1977/78	59,682	232.23	121.82	110.40

*Instructional costs of mainstream PRISM as determined by the resource consumption approach (from Tables 3A-6A).

N.A. = Not Applicable

Design costs have generally exceeded operation costs, but this will change since most design has been completed and design costs should rapidly decline. Investment costs will decline gradually as amortization periods mature.

College Support Costs

On first inspection of the preceding tables it appears as if the college has paid a considerable amount toward program support. Technically this is true; however, the cost to the college has not been as great as it appears to have been. To understand this it must be remembered that PRISM represents an approach toward fulfillment of a recognized need: to provide basic remedial instruction in chemistry in order that students may enroll in and satisfactorily complete courses that require knowledge of basic chemistry (e.g., General Chemistry and nursing).

The college would have had to pay the cost of the instructional staff even had there been no grants to support PRISM. The discussion which follows will use this bit of reasoning to identify more accurately the college's share of the program costs.

To identify the college's share of the cost, two sets of figures were compared for each program year: the amount of faculty salaries which appears in the Resource Consumption column of Tables 2-6, and the total amount of the College Support column. These figures and their difference are displayed in Table 8 (when the college support exceeds faculty salaries, the difference is said to be negative):

TABLE 8

Annual College Support Costs

Program Year	Faculty Salaries	College Support	Difference
1973-74	$ 3,913	$ 897	+ $ 3,016
1974-75	26,359	20,562	+ 5,797
1975-76	24,418	16,880	+ 7,462
1976-77	25,464	28,061	- 2,597
1977-78	24,682	24,983	- 301
Net Difference	$(104,836)	$ (91,383)	+ $ 13,377

Table 8 indicates that while college support costs have exceeded faculty salaries for the last two years, the program has in fact not been a cost to the college. It is even fair to say that, because of the grants' support of faculty salaries, PRISM has supported the college by approximately $13,303. That is, while the college provided approximately $91,000 to support the grant during the five year period, the grants supported approximately $104,000 in faculty salaries. In this trade-off of costs, the college benefited. This benefit, if expressed in 1978 dollars, would be $18,096 (determined by computing 10% compound interest on the money - see Appendix C).

Part III
Benefits to the College

Benefits may accrue to society, students, faculty and institutions. Because of the complexity and primitive state of the art of determining the value of benefits generated by educational programs, this analysis will be restricted to those benefits which accrue only to the college in which the program is housed. Even then, this report will not investigate all possible benefits to the college.

This study specifically examines benefits that accrue to non-PRISM courses utilizing some PRISM component, and those which accrue to the college as a result of PRISM's impact on students in terms of attraction to the college and the retention and future success of students in General Chemistry.

Benefits To Courses Which Adopt PRISM Components

Benefits accruing to courses which adopt PRISM components may be quantified in terms of the value of Design and Investment which entered into the development of the components. When computing the value of Design activities attributable to a program, Design costs are treated as an investment, amortized over a period of time and "charged" to the user.

Design costs were not amortized in Tables 2A-6A, although the total annual Design costs were assigned to specific instructional modalities. This information has been compiled, and reported in Design columns of Table 9. Two assumptions on which data in Table 9 are based are:

TABLE 9

ANNUAL INVESTMENT AND DESIGN COSTS
BY INSTRUCTIONAL MODALITY

Year	ISS		IS/RS		SRS		TOTAL*
	Design	Invest.	Design	Invest.	Design	Invest.	(For Check)
1973/74	7,286[a]	309[b]	0	0	0	0	7,595
1974/75	15,058[c]	565[c]	0	0	1,292[d]	0	16,915
1975/76	12,122[e]	3,468[f]	4,176[g]	3,703[h]	819[i]	1,770[j]	26,058
1976/77	17,399[k]	3,916[l]	1,197[m]	3,703[n]	1,032[o]	1,770[p]	29,017
1977/78	16,944[q]	9,133[r]	2,881[s]	4,053[t]	1,328[u]	1,770[v]	36,109

*When added to operation costs, total will equal instructional subtotal of tables 2-6.

SOURCES:

a - From Table 2: All Instructional Staff, Consultant, and Media Services;

b - From Table 2: Software and Hardware;

c - From Table 3A: ISS Costs;

d - From Table 4A: SRS Costs;

e - From Table 4A: 90% of Faculty and Support Personnel Design Costs plus media Services Costs;

f - From Table 4A: ISS Investment Costs (See Appendix A, Table 3, Hardware);

g - From Table 4A: Travel and Consultant Costs;

h - From Table 4A: IS/RS Investment less ISS and SRS Investments (in parens, Table 4A);

i - From Table 4A: 10% of Faculty and Support Personnel Design Costs;

j - From Table 4A: SRS Investment Cost (See Appendix A, Table 4A, Hardware);

k - From Table 5A: 90% of Faculty and Support Personnel Design Cost plus Media Services;

l - From Table 5A and 4A: Software Costs plus ISS Hardware Investments (See Table 4A & Appendix A Notes re: Hardware);

m - From Table 5A: IS/RS Travel and Consultant Costs;

n - No Hardware was purchased in 1976/77; therefore same amount as previous year;

o - From Table 5A: 10% of Faculty and Support Personnel Design Costs plus SRS Consultant Costs;

p - No additional hardware purchases;

q - From Table 6A: 90% of Faculty Support Personnel Design Costs plus Media Services and ISS share of Consultant Costs;

r - From Table 6A: All Software, all Facilities plus ISS Hardware Investments to date ($4,301);

s - From Table 6A: Travel Costs plus IS/RS Consultant Costs;

t - Previous Hardware Investments plus amortized share of $3,500;

u - From Table 6A: 10% of Faculty and Support Personnel Costs plus SRS share of Consultants;

v - No additional hardware purchases.

1) Faculty design costs were primarily attributed to ISS Modules (90%) rather than SRS programming (10%).

2) Support Personnel design activity pattern follows that of faculty.

Investment columns of Table 9 contain investment costs incurred for specific modalities. Costs in the Investment columns are summative, that is, the reported costs include amortized amounts from prior years. Costs in the Design columns are not summative.

Before benefits can be computed from Table 9 data, allocations must be made between modalities since ISS and SRS contribute to IS/RS and vice versa. The allocation procedure and benefit calculation is detailed in Appendix B and summarized in Table 10.

The basic assumptions that entered into the construction of Table 10 were:

1) Design activities have an average investment life of five years*.

2) Benefits accrue in direct proportion to enrollment.

3) Amortized benefits must be applied in the year that they are "due"; thus the amortized amounts may be charged only to the instructional modalities in operation.

Only four sets of figures in Table 10 can be viewed as benefits for reasons explained in the table's footnotes. However, it was necessary to construct the entire table in order to arrive at those costs.

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*In reality, Design life varies with obsolescence rate of the content and with media faddishness. In the present case, it is anticipated that over 90% of the design activities will have a "payoff" period of 10 years or more. Nevertheless, a more "reasonable" amortization period, is desirable. Five years was selected to be a more acceptable period than ten years.

TABLE 10

INVESTMENT AND DESIGN BENEFITS
ACCRUING TO INSTRUCTIONAL MODALITIES
BY YEAR OF OPERATION

YEAR	ISS		IS/RS		SRS		ISS (HARDWARE)	
	# Stud's.	Benefits	# Stud's.	Benefits	# Stud's.	Benefits	# Stud's	Benefits
1 - 1973/74	68	$ 1,767*	0	0	0	0	0	0
2 - 1974/75	154	5,296*	0	0	0	$ (260)	0	0
3 - 1975/76	0	(10,362)	168	$17,096*	0	(2,195)	0	0
4 - 1976/77	0	(14,291)	244	31,380*	68	2,409	0	0
5 - 1977/78	30	2,530	257	28,047*	48	1,180	47	3,215

*Indicates mainstream PRISM courses. Claiming these amounts as benefits is inappropriate because they are self-generated and may be more appropriately viewed as cost.

NOTE: Parentheses indicates benefits toward a specific modality for which no students were enrolled. These amounts are listed as a matter of record to aid in computation of benefits for subsequent years when the modalities were in operation.

The reader will need to examine Appendix B carefully to understand how the amounts in Table 10 were derived. In general, each year's benefits equal the summative effects of a five year amortization of the Design costs identified in Table 9 plus all the Investment costs for the particular year under consideration. The totals thus derived were then allocated to related modalities according to rules described in Appendix A and basic assumptions used to construct Tables 9 and 10.

Benefits to College via Student Retention

Students who enroll in PRISM have insufficient knowledge of basic chemistry required for the General Chemistry course. It would be anticipated that the attrition rate of these students would be at least comparable to that of students who have met prerequisites. Further, it would be reasonable to expect a higher attrition rate from students in the PRISM program since they were generally not as successful in high school.

Informal observation of attrition rates indicate that there have been no failures of General Chemistry by PRISM students. This analyst will not attempt to provide convincing evidence that the success of PRISM students is in fact due to the PRISM program, but will make the assumption that the PRISM program has some positive relationship with the success. The remainder of this section will posit a hypothetical situation, modeled close to reality, in which student retention in General Chemistry is attributed to PRISM materials/instruction. The value of benefits accruing from this retention will be estimated.

For the hypothetical case, assume an annual initial enrollment in General Chemistry of 180 students, eight of whom are former PRISM students. Assume further that the final enrollments totals 110 students resulting from a 39% attrition rate. As discussed above, it would be anticipated that, PRISM students would experience approximately the same attrition rate as the other students, and that about three would fail General Chemistry. However, no PRISM students failed General Chemistry.

These students passed and enrolled in the second semester of General Chemistry.

Using the simplest computations, it is easy to arrive at the conclusion that the PRISM courses appear to be responsible for the retention of three students who would normally fail General Chemistry. The fact that these students can enroll for the second semester and continue their program is worth three times the average semester tuition $417, or $1,251 per year to the college.

Miscellaneous Benefit Areas

There appear to be other areas of benefit to the college which are discussed briefly here. This treatment is necessarily brief because the evidence of benefit is based on informal observations and requires more data collection effort than is possible within the scope of the present study.

New students. There is evidence that PRISM attracts some students to the college as a result of word-of-mouth referrals. If it can be demonstrated that PRISM attracts just eight students per year who would otherwise not attend the college, then simple calculations would show that the value of benefits to the college increased by at least $8,560 per year [8 x $535 x 2 semesters].

Increased instructional efficiency. There is some indication that PRISM permits instruction of up to one third more material per semester when compared to conventional patterns. Furthermore, students appear not

to " suffer" from this greater learning intensity. If true, this increased efficiency has implications for the reputation of the college relative to the quality of its chemistry, and related programs. Such enhanced reputation may result in increased number of applicants, increased political support, or some social gains which may be quantifiable. Obviously this is a complex area of benefit measurement and would require diligent investigation.

Instructional Effectiveness. Retention, one aspect of instructional effectiveness, has been discussed. There is another aspect of PRISM's effectiveness which could lead to easily quantifiable benefit: because of it's structure, PRISM presents an opportunity for the college to reduce costs in the preparatory program by engaging a lower paid "young" or new faculty person to instruct some or all of the preparatory chemistry at a level of competence normally associated with more experienced faculty. The system--if properly managed and maintained--assures continued quality. It should be noted that it is easier to learn the proper operation of PRISM than to build an effective, efficient traditional instructional repertoire. This option assumes, of course, that the new faculty person is a "believer" in PRISM and utilizes it fully. There are two distinct areas of benefit associated with this option. One is that the same quality of instruction can be maintained at a lower cost, the other is that the developer of PRISM would be freed from his involvement in Preparatory Chemistry to extend the use of PRISM to other areas with the likelihood of increasing efficiency and effectiveness in those areas. Of course there may be other problems which would benefit from his skills.

Extending PRISM. Extending PRISM to other instructional areas would appear to lead to benefit through increased efficiency and effectiveness. Naturally this would require additional investments for some hoped-for benefits. The "hoped-for" benefits need to be identified and can be projected based on the results of the fifth year evaluation outcomes of PRISM. These outcomes have not been finally determined, but should be examined in concert with this report.

Part IV - Summary

Summary of Selected Costs

PRISM has been a high cost program, but much of the cost has been associated with hardware, with software development, and with learning how to use the system effectively. These cost have been borne by outside funding and by the Project Director who has contributed large amounts of time outside the normal workday (if there is one). The cost to the college has been small with benefits far outweighing the costs.

A five-year summary of the cost per student and student enrollment is portrayed graphically in Figure 1, along with two measures of physical growth: the number of ISS modules and learning stations available. These attributes were selected for portrayal because they show the effect of cost per student as enrollment increases even as investments climb. For example, the impact of large hardware investments during the fifth year was not as dramatic as it was in the third year.

The number of modules and learning stations reflect PRISM's capacity to handle students. With the addition of fifteen learning stations in 1977/78, PRISM's ISS capacity theoretically quadrupled thereby offering a path to greater efficiencies.

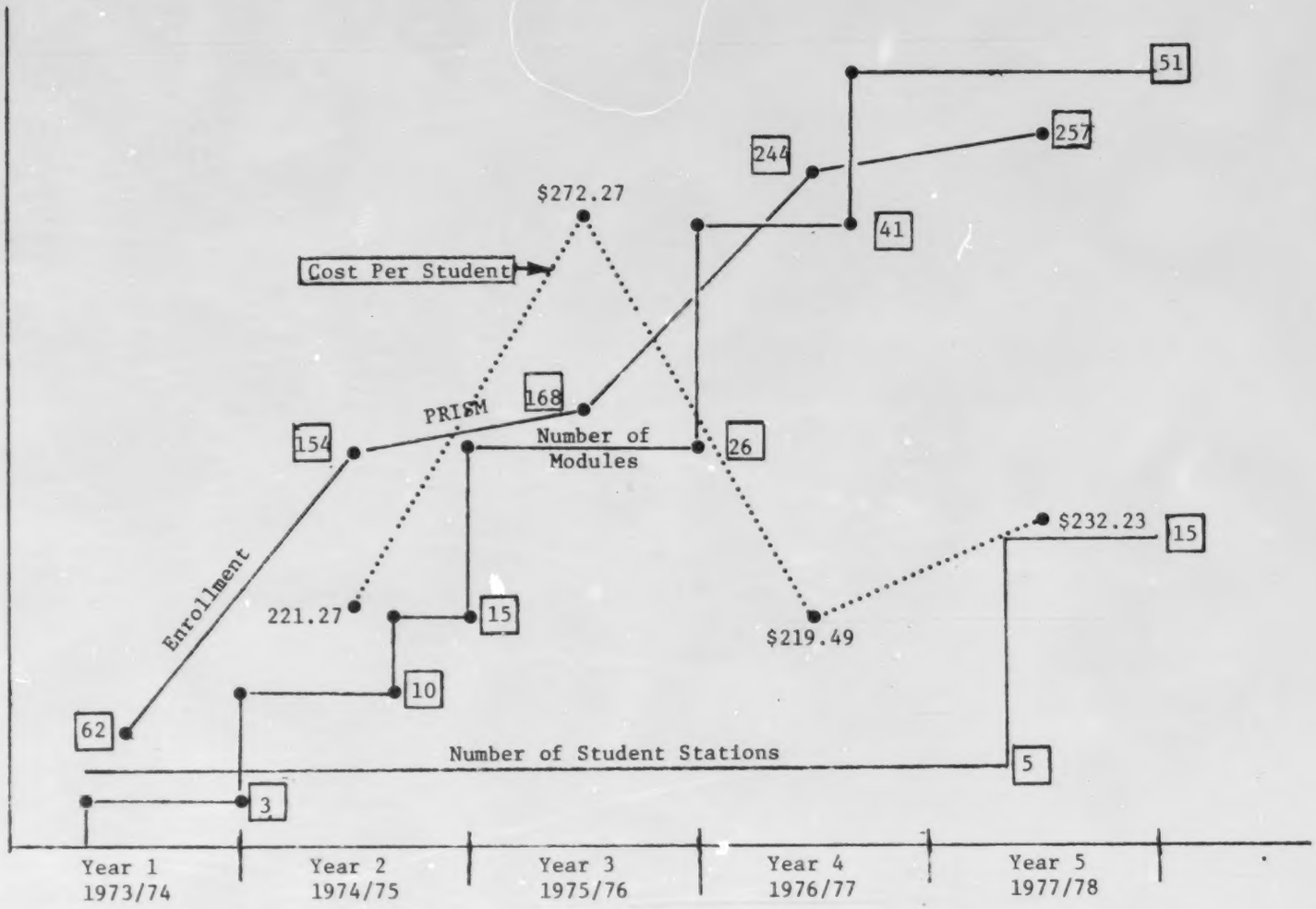

Fig. 1 - Summary: Annual PRISM Enrollment, Cost Per Student, and Numbers of Modules & Learning Stations

Figure 2 suggests what enrollments might be required to achieve most efficient levels.

Figure 2 uses as the cost base only those instructional costs which seem likely to accrue annually to the college. This includes 1978 faculty salaries, support personnel salaries and a "fudge" amount of $500 to be applied to materials for program revisions. The historical investment costs are also included in Figure 2 by way of the costs in parentheses which follow the primary costs.

The steepness of the curve in Figure 2 indicates the degree of efficiency of use. The steeper section indicates greater efficiencies are possible. A high enrollment (approx. 1000 students) would be necessary to achieve highest efficiency levels, but it is not necessary to achieve maximum efficiency levels. More realistic efficiency levels are possible around the point of inflection which appears to occur between enrollments of 400 and 700. Achieving such high levels of enrollment in the mainstream PRISM program may seem absurd, but the size of the PRISM program is determined, and limited, by the number of courses which adopt the methods and materials. Obviously outright adoption is not feasible, but additional investments could be made to make the PRISM approach feasible to larger numbers of students. Naturally, the cost curve of Figure One would not be applicable, and revised computations would be required. However, the efficiency principle holds, and it should be recalled that PRISM components are currently serving 428 students.

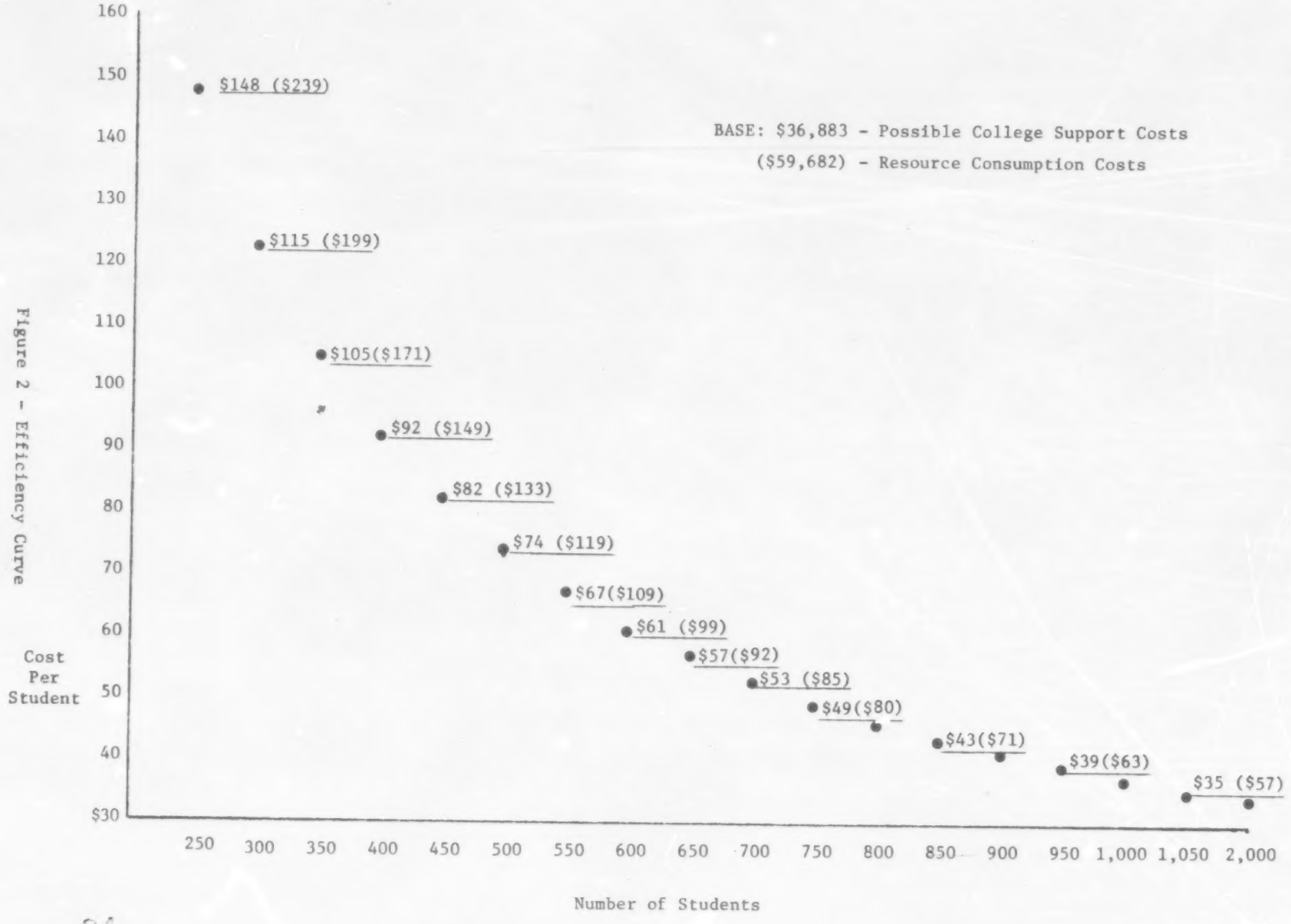

Figure 2 - Efficiency Curve

Summary of Selected Benefits

Benefits to the college have included the following estimated amounts in 1978 dollars (in parens) and in dollars actually spent year-by-year:

Administrative and faculty costs, less grant support - 5 years (see discussion accompanying Table 8)	$ 13,377	(18,166)
Hardware - 5 years	$ 101,248	($115,374)
Software (development costs) - 5 years	$ 34,161	($41,258)
Use of PRISM components by other courses - 2 years	$ 9,334	($10,030)

In addition to the above benefits, there is evidence that additional benefits accrue yearly:

Student retention (assume 3 students)	$ 1,251
New students attracted by program (assume 8 students)	$ 8,560

Additional benefits which the analyst has not attempted to quantify seem likely. Total benefits which have been quantified for this past year have a 1978 value of approximately $62,469 (based on year 5 benefits given in the Table in Appendix C plus the two yearly, assumed benefits listed above).

Future Costs

This study has not been focused on making cost projections and a more intense effort would be required to do so. However, some conservative statements about future costs can be made.

Considering only those costs which will accrue to the college (i.e., eliminating investment costs which have been carried for the purposes of viewing resource consumption), it is unlikely that PRISM course costs will exceed those of other courses with the exception of the need for the ISS lab manager (previously identified as the assistant director). There will be modest needs for updating/revising materials and for secretarial skills; however these will probably not be exceptional costs.

Regarding the cost of the ISS lab manager, it will approximate the value of the benefits which appear to accrue from PRISM's ability to attract new students and to retain enrolled students.

APPENDIX A

Derivation of Cost Data

Tables 3,3-A - 7,7-A

APPENDIX A

Derivation of Cost Data

Tables 3,3-A - 7,7A

For All Tables: Personnel costs (including Faculty and Media Services) include 27% fringe benefits (full time employees only).

Administration costs are derived from Table 1.

Media personnel includes salaries for personnel involved in production of ISS modules. Typically included are: photographer, graphic artists, media specialists.

Support personnel includes a secretary-typist and (for years 4 & 5) an assistant director who supervised the ISS lab portion of the program.

Software/hardware: Costs are amortized (straight line basis). For convenience, and to avoid a "cents" figure, first year costs may be different than costs for subsequent years.

To arrive at the portion of time the Project Director spent on design activities, the following guidelines were used:

1. A years activity is as follows

   Fall semester (15 weeks) = 35%
   Spring Semester (15 weeks) = 35%
   Summer (13 weeks) = 30% (two sessions @ 15%)

2. The project director estimated that 10% of the fall term, 30% of the spring term, and 80% of the summer sessions were devoted to Design and Development of the program. These estimates account for 33% of a professional year. Evenings spent on the project counts as professional time. Therefore, although much of the project design occurs as "donated time" or "overload", the 33% is used to estimate the salary portion attributable to design activities.

Table 2

Faculty: The $111 difference between colums 1 and 2 is attributable to a portion of the (assumed) 27% of F.B.* The same reason accounts for the $61 difference for Media Services.

Software: $242 of software was purchased, $69 from school funds (cassettes). The figure in column 1 ($62) reflects the first year costs of a four year amortization plan.

Hardware: $2,479 was spent on hardware, $247 reflects the first year costs of a 10 year amortization plan.

Table 3 See comments "For All Tables" at beginning of Appendix

Faculty: $26,359 represents salaries for assistant director ($2,507) and project director ($13,485 salary, plus $1,200 for evening sources plus $1,050 for summer session). F.B. added.

Software: $1,019 amortized over four years - $257 first year costs. This is added to current costs from previous year ($60).

Hardware: No purchases. $248 represents amortized costs of previous purchases.

Table 3A See comments for Table 3 and "For All Tables".

Faculty: Assistant director: supervised learning lab for ISS students (operation cost).

Project director: 33% of time devoted to design activities (5% to SRS planning). 67% devoted to operation.

Support personnel: Design activities are presumed to follow pattern of project director.

TABLE 4 See comments "For All Tables" at beginning of Appendix

Faculty: $24,418 represents salaries and F.B. for assistant director ($2,400) and project director ($14,227 salary, plus $1,200 for evening courses, plus $1,400 summer). F.B. added.

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*F.B. = Fringe Benefits

Table 4A	See comments above for Table 4 and "For All Tables".
Faculty:	Operation costs reflect ISS lab supervision by assistant director and 67% of project director's time. Design costs reflect 33% of project directors time.
Support Personnel:	Design activities are presumed to follow pattern of project director.
Hardware:	Amortization on $64,909 divided among IS/RS ($37,034), ISS ($10,175) and SRS ($17,700): IS/RS = 1 yr @ $3,707 (9 yrs. remaining @ $3,703) ISS = 1 yr @ $1,022 (9 yrs. remaining @ $1,017) SRS = 10 yrs @ $1,770 Add $248 to ISS (first year purchases)
Table 5	See comments "For All Tables" at beginning of Appendix
Faculty:	$25,464 represents salaries for two instructors. One instructor taught a summer section @ $1,400. The project director received ($15,650 salary plus $1,600 for evening classes, plus $1,400 for summer). F.B. was added. However, the project director's "cost" was reduced by $1,573--the estimated amount of his involvement in supervising a lab not related to the project.
Software:	Amortization = $453 (on current year purchases of $1,815), plus $1,884, plus $254, plus $60 (from preceding three years).
Hardware:	Amortization - year one = $248, year three - $6,490.
Table 5A	See comments above for Table 5 and "For All Tables"
Faculty:	Design costs reflect 33% of the project director's effort. All other faculty costs are operations. Faculty involved in SRS component were not PR TM faculty.
Support Personnel:	Includes a secretary-typist whose design activities are presumed to reflect the director's, and a non-faculty assistant director whose effort is entirely focused on Operations.

Consultant: The consultant examined both the IS/RS and the SRS components. The ratio of IS/RS enrollment to SRS enrollment is approximately 78:22, therefore, the consultants fee was split according to that ratio.

Hardware: Hardware which supports SRS activities is valued at $17,700. This purchase was made during year three. Thus, $1,770 is to be divided among SRS and IS/RS components. Similarly, $37,034 worth of hardware supports the IS/RS function and approximately half of the amortized cost is charged to SRS component. The 78:22 ratio is used to allocate those costs: $1,770 plus one half of $3,703. The balance of hardware costs is charged to IS/RS.

Table 6 See comments "For All Tables" at beginning of Appendix.

Faculty: Two faculty. Salary of one was $15,500 but his involvement was estimated to be approximately 8% (5/32nds x .50) during the spring semester. He also taught a summer session @ $1,400. The project director's salary was computed as $16,400 salary plus $1,600 for evening class, plus $1,400 for summer session, minus 25% of a semester--17/32nds of teacher load--for supervision of two labs not related to PRISM.

Software: Amortization - $2,040 (on current year purchase of $8,157) plus $454, $1,884, and $254 from the three preceding years.

Hardware: Amortization - $3,386 (on current year purchases of $33,860) plus $6,490 (year three) plus $248 (year one).

Facilities: $2,000 amortized for ten years.

Table 6A See comments above for Table 6 and "For All Tables"

Faculty: No faculty costs attributed to SRS nor ISS courses because those faculty were not involved in PRISM. Design costs represent 33% of project director's salary. Remainder of faculty costs are attributed to operation.

Consultant: Consultant time is allocated across all programs in proportion to student enrollment.

Support Personnel: Design activities of the secretary-typist are presumed to follow director's pattern. The non-faculty assistant director supervised students in ISS component of program, therefore, his time ($11,430) was allocated in proportion to student enrollment.

Services and Software: Costs are attributed solely to IS/RS and ISS on the basis of student enrollment.

Hardware: Hardware costs were apportioned among various instructional modalities according to function. Hardware supporting SRS has an investment cost of $1,770. This was distributed between IS/RS and SRS in proportion to enrollment. Hardware supporting ISS only has an investment cost of $4,301. This was distributed between IS/RS and ISS in proportion to enrollment. Hardware supporting IS/RS has an investment cost of $4,053. This was distributed among all three functions by first assuming that half of this investment supports the ISS function and half support the SRS function. Each half is then apportioned among two instructional modalities in proportion to student enrollment (Note: this method attributes a larger share of the cost to the IS/RS modality than would a simple three way allocation of total cost in proportion to enrollment) the detailed result of these allocations is shown below (the column totals appear in Table 6):

Total	IS/RS	SRS	ISS	ISS Hardware Only
$ 1,770	(.84) $1,487	(.16) $283	$ 0	$ 0
$ 4,301	(.77) 3,312	0	(.09) 387	(.14) 602
$ 2,027	(.84) 1,703	(.16) 325	0	0
$ 2,026	(.77) 1,560	0	(.09) 182	(.14) 284
$10,124	$8,062	$608	$569	$886

Facilities: Apportioned among IS/RS, and ISS--hardware only--according to enrollment.

Appendix B

Derivation of Costs for Table 10

Appendix B

Derivation of Costs For Table 10

A yearly account is given below. The formula from which amounts were derived is:

$$Bm_i = \frac{Di}{5} + \sum_{i=1}^{x} \left(\frac{D}{5}\right) + I_i$$

Bm = Benefits per modality.

i = Year of project.

Di = Design for a specific year of the project.

x = Last year of the relevant time horizon.

I_i = Investment for year i

Computations for each of the project years follows:

Year 1 - \$7, 286 ÷ 5 yrs = \$1,458 (4 @ 1,457) + \$309

Year 2 - ISS: \$15,058 ÷ 5 yrs = \$3,014 (4 @ \$3,011) + \$1,457 + \$565
SRS: [(\$1,292 ÷ 5)] = \$5,296

Year 3 - ISS: \$12,122 ÷ 5 yrs = \$2,426 (4 @ 2,424) + \$4,468 + \$3,468 = \$10,362.

IS/RS: \$4,176 ÷ 5 yrs = \$836 (4 @ \$835) = \$3,703 = \$4,539

SRS: \$819 ÷ 5 yrs = \$167 (4 @ \$163) + \$258 + \$1,770 = \$2,195

Allocate all to IS/RS = \$17,096

Year 4 - ISS: $17,399 ÷ 5 yrs = $3,483 (4 @ $3,479) + $6,892 + $3,916 = $14,291

IS/RS: $1,197 ÷ 5 yrs = $241 (4 @ $239) + $4,538 + $3,703 = $8,482

SRS: $1,032 ÷ 5 yrs = $208 (4 @ $206) + $425 + $1,770 = $2,403

Allocation[1]: ISS = 0%

IS/RS = All ISS x 78% of SRS + 50% $17,096 + 78% of (50% x $17,096) = $31, 380.

SRS = 22% of SRS + 22% (50% x $17,096) = $2,409.

Year 5 - Note: last year for 1973/74 Design Costs

ISS: $16,944 ÷ 5 = $3,392 (4 @ $3,388) + $10,371 + $9,133 = $22,896

IS/RS: $2,881 ÷ 5 = $577 (4 @ 576) + $4,777 + $4,053 = $9,407

SRS: $1,328 ÷ 5 = $268 (4 @ 265) + $631 + $1,770 = $2,669

Allocation[2]: ISS: (Software Invest. = $4,632; remaining investment = $18,264): 10% ($4,632) + 9% ($18,264) + 9% (50% x $9,407) = $2,530

ISS Hardware Only: 14% of $18,264 + 14% of (50% x $9,407) = $3,215

IS/RS: 90% of ($4,632) + 77% ($18,264) + 84% (50% x $9,458) + 77% (50% x $9,458) + 84% of SRS = $28,047.

SRS: 16% of SRS + 16% of (50% x $9,458) = $1,180

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[1] See notes in Appendix A for Table 5A-Hardware for rationale behind 78% and 22% allocation.

[2] See notes in Appendix A for Table 6A-Hardware for rationale behind various percentages (9%, 14%, 77%, 84%, and 16%).

APPENDIX C

Present Value/Constant Year Dollars

Appendix C
Present Value/Constant Year Dollars

Dollars spent one year cannot be fairly compared with dollars spent in another year. A conventional practice among resource economists and cost analysts is to bring all expressions of--historical, present, and future--costs into a framework of common value. This may be called discounting, compounding present value, or constant year dollars. The rationale for this technique is that the decision to spend money a certain way means alternatives were (or would have to be) discarded. The time value of the money assumes an investment at a specific compound interest rate as a standard alternative to which others can be compared; ten percent is a common choice. The results of achieving constant year dollars can be understood if one assumes that one can invest 65¢ at 10% compound interest and receive $1.00 in five years. Thus a dollar today is worth more than $1.00 in the future. Similarly, dollars spent in the past were worth more then than today's dollar is now.

The following Table shows the cumulative present value of money spent during the past five years of the PRISM program.

Table C-1

Selected Yearly Costs and Benefits With Total

Benefit Value Expressed In 1978 Dollars

Year	Factor[1]	Support Costs[2]	Benefits[3]		Benefits to:		
		Faculty	Hardware*	Media Srvc.*	ISS	SRS	ISS (H)
1	1.538	$ - 3,016	$ 2,479	$ 2,277	$ 0	$ 0	$ 0
2	1.398	- 5,797	0	7,801	0	0	0
3	1 171	- 7,462	64,909	4,748	0	0	0
4	1.145	2,597	0	10,410	0	2,409	0
5	1.050	301	33,860	8,925	2,530	1,180	3,215
	TOTAL:	$ -13,377	$101,248	$ 34,161	$ 2,530	$ 3,589	$ 3,215
1978 Dollars	-TOTAL:	$ -18,166	$115,374	$ 41,258	$ 2,657	$ 3,997	$ 3, 376

1. Equivalent to an arithmatic average of beginning and end year compound interest factor (10%).

2. Negative cost indicates the grant's share of salaries exceeded the college's share.

3. This label is not entirely accurate since the fifth academic year ended in 1978.

*Amounts equal grant amounts

NOTE: Except for last row, the amounts listed are those incurred/accrued during the given year. They have not been adjusted for the factor shown for that year.

PART IV

SUMMARY, IMPLICATIONS, RECOMMENDATIONS

The two cost studies indicated that a functional cost study can be realistically accomplished and that they reveal more about the true costs of a program than do the various financial records maintained to account for the cost of the program elements. This report closes with three observations concerning implementation of a functional cost analysis, comments about how the two studies will be used internally, and a recommendation for those interested in further developing functional cost analyses evaluations.

Time Required to Conduct Studies

The first cost study required about two days of on-site data collection and approximately two weeks of calculation and write-up time. An additional three or four days, spread over a month's time, were required to "tidy up" the report and correct inconsistencies.

The second study required about a week to comprehend the nature and structure of the program. Three on site meetings and several phone calls were required. Much of the cost data were presented in summarized form by the Assistant Director who researched five years of accounts. This required approximately a week of his time. Sorting this data, performing calculations and preparing a draft narrative required about three weeks while an additional week was required to check inconsistencies and prepare a final draft. A day was required to brief the project director on the report.

The above detailing of time required suggests that between three and six weeks of effort are required to perform a functional cost analysis. This was spread over several months. Thus, a real concern has to be who would perform an internal analysis.

If spread over a much longer time--say six months, faculty could probably accomplish the task. However, to train faculty in the process would probably require two two-day workshops. The first workshop would be to introduce faculty to cost concepts; the second, a follow-up after several months' would be conducted to evaluate their application of the concepts. It might be more realistic to have a full-time internal evaluator become proficient in the techniques.

Cooperation Required

Personnel involved in the program must want the cost evaluation performed. Further, they must be willing to do a great deal of the data gathering themselves either by keeping record of their time, or by searching out financial information, and conferring with the cost analyst.

The task can be "laid on" a department or other unit by a strong, influential administrator. This was not required in the two studies reported herein; however, the analyst's previous experience is that it is possible for that form of data collection to work satisfactorily. It would be advisable to have regular meetings (department meetings are ideal) in which the cost study would be a recurring topic.

The cooperation provided in the two cost studies was exceptional; but few people were involved. An attempt to collect cost data from a larger program was foiled when four faculty decided they did not want to divulge information about how they spent their time.

Record Keeping

Keeping records of the amount of time devoted to various types of tasks is bothersome. This needs to be kept to a minimum. Even once-a week reports are troublesome. The analyst will attempt to routinize future self reports through a control mechanism such as a post card or phone call which would trigger a review of the preceeding weeks' activities. An option would be to make provision for a cost study to be a recurring agenda item in group meetings.

These approaches would require generalizing data over time, and the validity of the generalization will always be suspect. However, in terms of practical application, it appears to be the only solution until "Big Brother" comes along. It should be apparent that such generalizations are likely to provide a more accurate portrayal of program costs than those costs found in conventional financial/budgetary statements.

Internal Use of the Cost Reports

Occupational Therapy. Upon their review of the reports, O.T. personnel stated they would use the information to make a case for additional funding from outside sources. They felt they could make a case that they were a good investment (based largely on the value of their donated time). In addition, the report suggests that the college recieves more than it pays in terms of project support and that information could encourage internal support.

Preparatory chemistry. The project director of the chemistry program will be seeking college support for his program, and will have to justify certain costs, e.g., salary for the manager of the learning lab. The report makes a strong case that the program is now generating quantifiable benefits approximately equal to extra costs involved. Furthermore, the case can be made that future production efficiencies (cost per student) can be realized if there is a wider adoption/adaption of the system.

Recommendation

Functional costing needs further application in order to explore it's evaluation and communication value. Based on two studies, it appears to have considerable merit in these areas. The drawback is that few people are aware of the functional cost perspective and thus cannot begin to view their costs that way. Development of orientation workshop materials would appear to be the next step. Implementing workshops would also test the level at which it is appropriate to expect the costing to occur.

One cannot expect functional costing to replace current practices of institutional accounting. It is an evaluation tool, not an accounting tool. Therefore--although current accounting practices could be modified somewhat to a more functionally oriented output--the lead in functional costing must be taken by administrators and faculty in need of better management information; and by evaluators. It may be that faculty would perform functional costing of their programs. More likely an internal program evaluator is the appropriate person. Regardless of who, training and training materials appear to be required.